

**A FEASIBILITY STUDY  
OF A NEW ZEALAND  
LOG FUTURES MARKET**

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## **ABSTRACT**

If the input or selling price of a commodity changes in a negative manner the effect on business profits and investment worth can be disastrous. The risk of this occurring is defined as “price risk”. Price risk is inherent in New Zealand forestry markets.

Futures markets trade contracts with standardized specifications for the purchase or sale of commodities, or financial instruments, at predetermined delivery dates in the future, at prices agreed upon when the contract is entered. These markets provide two essential economic roles: hedging and price discovery. Essentially, they act as a means to eliminate unwanted price risk.

The objective of this research is to determine the feasibility and likelihood of a successful futures market for the New Zealand forestry industry, and to develop the specifications of a contract, if one is feasible, which has the greatest chance of success.

The nature of futures markets is first explored. This is followed by an investigation of prerequisites for successful futures contract innovation. The commodity and market characteristics of the New Zealand forestry industry are then defined, and using all this information, the feasibility and likelihood of success of a futures market for the New Zealand forestry industry is then determined.

The essential conclusion of the research is that a successful log futures contract is feasible, and contract specifications are consequently defined. The basic recommendation is therefore that the NZFOE consider listing a log futures contract reflecting the specifications detailed in the research.



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**PART I:**  
**INTRODUCTION**

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## **1. The Forestry Industry in New Zealand**

In 1994, New Zealand's forestry export receipts totalled \$NZ 2.467 billion, representing 12.89 % of total merchandise export revenues. Forestry is New Zealand's third largest export earner and accounts for 6 % of Gross Domestic Product.

Planted production forests cover 1.3 million hectares, or 5 %, of New Zealand's 27 million hectares of land. The biggest concentration of plantations is in the central North Island, with radiata pine being the predominant species. Radiata pine makes up just over 3 % of the global softwood forests, and a third of this radiata pine resource grows in New Zealand.

The industry is preparing for change in the future. New Zealand's annual log harvest is forecast to increase from 15.8 to 40 million m<sup>3</sup> by the year 2020. International demand for wood is expected to increase by more than 40 % over the same period, while traditional sources of supply will decline.

## **2. The Concern of Price Risk**

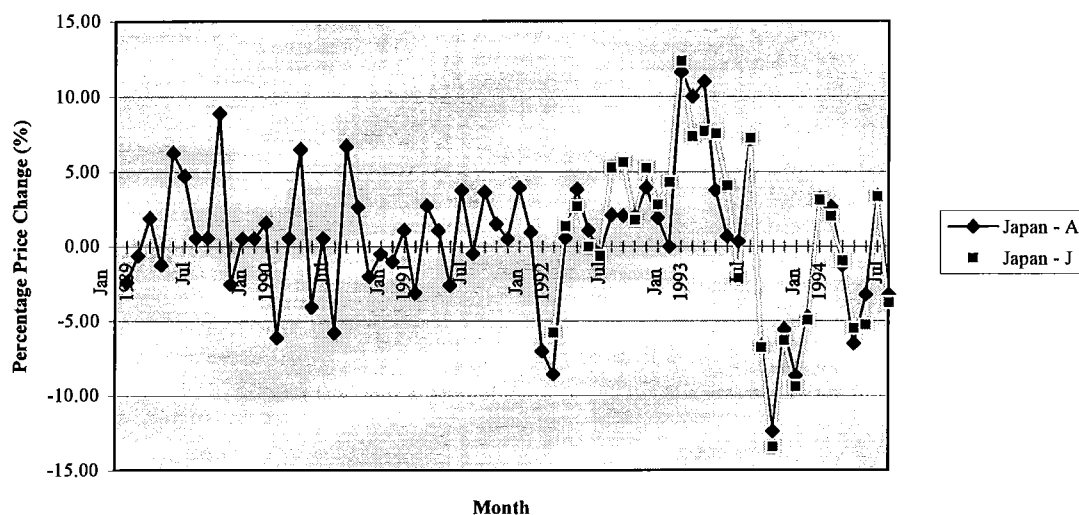
If the input or selling price of a commodity changes in a negative manner the effect on business profits and investment worth can be disastrous. The risk of this occurring is defined as "price risk". Price risk will occur, firstly, when the commodity price is volatile, and secondly, when there is a mismatch in the time at which an individual's buying and selling prices are set.

Despite the industry's size, price risk inherent in forestry markets is undoubtedly real and significant in magnitude. Further, as the industry expands in the future and supply and demand dynamics change, the effect of price risk may become more notable.

Figure 1 illustrates the volatile nature of the two main log markets for New Zealand's radiata pine by graphically representing percentage price changes over time. Prices for Japanese — A grade logs rose from \$NZ 215 per m<sup>3</sup> in January 1993, to a high of \$NZ 329 per m<sup>3</sup> in August. However, just five months later the price fell back to \$NZ 221 per m<sup>3</sup>. This equates to a 53 % increase in prices over seven months,

followed by a 33 % fall in the following five months. Japanese — J grade logs experienced similar price movements.

**FIGURE 1: VOLATILITY OF JAPANESE EXPORT GRADE LOGS**



Source: Forestry Statistics Section, Ministry of Forestry.

Note: This monthly data was collected from: 1989 - (August) 1994, for Japan — A; and (February) 1992 - (August) 1994, for Japan — J.

Although Figure 1 considers only one section of the total forestry market, the main log markets, all sub-markets within forestry have price risk. As a result of space constraints, graphs showing price risk in these sub-markets have been excluded.<sup>1</sup>

Continuing, and possibly increasing, levels of volatility in forestry markets produce considerable risk to the forestry investor, log consumer, and subsequent sub-markets which require wood as their original element of input.

<sup>1</sup> Within the forestry industry, other sub-markets include:

- *Standing timber*: immature trees, still growing, that is they are at a sub-optimal harvest stage of growth.
- *Stumpage*: fully mature trees ready to harvest but still standing. A forest block may be considered as stumpage for up to two years, before being harvested.
- *Sawn logs*: harvested stumpage becomes a product known commonly as the log.
- *Timber*: Logs are processed at a timber mill into sawn planks, for example 2 x 4 planks.
- *Plywood*: Strong thin board made from gluing layers of vinier crosswise.
- *Pulp*: Cut from trees which are too small or of lacking in quality, pulp is made into paper.

### **3. The Futures Market**

Futures markets trade contracts with standardized specifications for the purchase or sale of commodities, or financial instruments, at predetermined delivery dates in the future, at prices agreed upon when the contract is entered.

Futures markets provide two essential economic roles. Firstly, entering the futures market provides *hedging* or insurance facilities for commodity producers and consumers by providing an offsetting gain in one market for a loss taken in another. Secondly, the existence of a futures market provides *price discovery* or the forecasting of future prices. Essentially, the futures market may be considered as a means to transfer risk from consumers and producers of commodities who want to reduce their risk on forward prices, to those consumers, producers or speculators willing to bear that risk. The market therefore allows a party who fears a movement in price to establish a forward price for the exchange of the commodity with another party who fears an opposite movement in price. The exchange guarantees the performance of these contracts and so there is no possibility of either party incurring a loss through contract default. As a result of eliminated price risk, business costs will be more certain which procures production efficiency and better profitability at a micro level, and improved resource allocation at a macro level, both of which ultimately yield increased social welfare.

However, not all commodity markets have the capacity to support a futures market in an efficient and effective manner and factors and conditions which indicate that a market is feasible do not necessarily ensure its success. Therefore, developing a successful futures contract is very difficult. A successful commodity futures market requires, *inter alia*: an underlying market on which to base the contract; a degree of price volatility in this market; a product which is capable of being traded on the basis of physical description; a large cash market; and a competitive and unregulated underlying market with freely flowing information. Ultimately, however, the demand for a contract dictates success, and therefore, contract specifications must reflect industry practices to attract hedgers and speculators.

#### **4. Objectives of Research Program**

The objective of this research is to determine the feasibility and likelihood of a successful futures market for the New Zealand forestry industry, and to develop the specifications of a futures contract, if feasible, which has the greatest chance of success. This overall research objective can be segregated into five objectives:

1. Identify the nature of futures markets; the mechanics of trading, the economic roles, and the possible detrimental effects.
2. Explore and identify the prerequisites for successful futures contract innovation.
3. Define the commodity and market characteristics of the New Zealand forestry industry.
4. Determine the feasibility and likelihood of success of a futures market for the New Zealand forestry industry.
5. Develop the specifications of a futures contract, if feasible, which has the greatest chance of success.

#### **5. Ambit of Research**

The research is divided into five parts. Part I recognises the problem of price risk in the New Zealand forestry industry and introduces futures trading as a possible solution.

Part II discovers the theoretical support for futures markets as a means to eliminate price risk. This part will begin with a section introducing the mechanics of futures trading and how they evolved. The second section will identify the economic roles of futures markets, and the third section will consider possible detrimental effects of futures markets.

Part III recognises the relative success and failure of futures contract innovation which has made it impossible to develop a theory of successful futures contract innovation. This will be followed by two exploratory sections considering the approach

of the literature in futures contract design. These sections will explore commodity and contract characteristics of successful innovation.

Part IV reviews the New Zealand forestry industry. The first section will overview the industry. The second section will describe the commodity characteristics of logs and timber. This will be followed by two sections considering the respective supply and demand dynamics of the industry.

Part V determines the feasibility and likelihood of success of a futures market for the New Zealand forestry industry. This assessment will be based on the compatibility of the market and commodity characteristics of the forestry industry, as determined in Part IV, with the conditions and requirements for a feasible and successful contract, as determined in Parts II and III. First, the survey which was necessary to obtain information not available from any other source is described. Second, price volatility and the demand for a contract is determined. Third, the size of the cash market is calculated and liquidity of the futures market is estimated. Fourth, the level of price competition in the underlying markets is investigated. Finally, homogeneity, transaction costs, product storability, some contract specifications, and margin issues are addressed.

Part VI concludes the study by offering recommendations to the SFE and the NZFOE and defines contract specifications.

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**PART II:**  
**THE FUTURES MARKET**

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# **1. What are Futures?**

## **1.1 Introduction**

Futures markets are organised exchanges which trade legally binding contracts with standardized specifications. The standardised contracts provide for the purchase or sale of commodities, or financial instruments, at predetermined delivery dates in the future at prices agreed upon when the contract is entered.

Positions can be of two types — long or short. A long position involves an agreement to buy, at the delivery date, the specified grade and quantity of the asset, at an agreed price. An agreement to sell, under the same specifications, is termed a short position.

Futures markets provide two essential economic roles. Firstly, entering the futures market provides *hedging or insurance facilities* for commodity producers and consumers by providing an offsetting gain in one market for a loss taken in another. Secondly, the existence of a futures market provides *price discovery or the forecasting* of future prices. These economic roles confer significant advantages to participants of those commodity markets who enjoy a complementing futures market. Essentially, the futures market may be considered as a means to transfer risk from consumers and producers of commodities who want to reduce their risk on forward prices, to those consumers, producers or speculators willing to bear that risk. The market therefore allows a party who fears a movement in price to establish a forward price for the exchange of the commodity with another party who fears an opposite movement in price. The exchange guarantees the performance of futures contracts and so there is no possibility of either party incurring a loss through contract default. Because of these functions, futures markets provide for better allocation of resources in society.

Previously risk reduction has been partly achieved by forward markets, from which futures eventually evolved. Although futures have several advantages over forward contracting, they have been criticised for imposing detrimental effects on society. However, evidence of detrimental effects is inconclusive.



The objective of Part II is to describe the nature of futures as a prelude to investigating the success and failure of contracts, and the subsequent compatibility of futures trading to the New Zealand forestry industry and design of contract specifications.

## **1.2 The Mechanics of Trading**

Before considering futures it is appropriate to consider forward contracting from which futures evolved. A *forward contract* is an agreement between two parties, a buyer and seller, concerning the delivery of a commodity at some future date at a price which is agreed upon today. In a forward contract the buyer and seller negotiate all terms of the contract including quality, quantity, the date of delivery, and all terms of price and payment method. In this way the contract will be mutually acceptable to the specific parties concerned. A *futures contract* is similar to a forward contract, with the exception that all terms are standardized and only price is negotiated. Each contract is fully specified by the exchange, and because they are identical, contracts can be exchanged between parties — “sight unseen”. The futures exchange is a centralised location established for the trading of these contracts.

Use of a futures contract is not limited to those who actively produce or consume the specific underlying commodity, but can be extended to those who are active in the markets of products which are closely related by price (called cross-hedgers), and to those who wish to speculate on the price of the commodity.

### **1.2.1 Contract Specifications**

Table 1 provides, as an example, contract specifications for the New Zealand Wool Futures Contract. Considering these specifications, an agreement could be to buy at a particular price 2,500 kg of the New Zealand Wool Board Strong Segment Indicator in August 1995.

As can be seen from Table 1, contract specifications detail the underlying asset, unit size, price quotations, minimum fluctuations, contract value, mandatory settlement value, final trading day, settlement method, mandatory settlement price, tick size, initial margin, and settlement months.

**TABLE 1: CONTRACT SPECIFICATIONS OF THE NEW ZEALAND WOOL FUTURES  
CONTRACT (1993)**

<i>Code</i>	<i>WFC (060)</i>
Underlying Asset:	New Zealand Wool Board Strong Segment Indicator.
Unit Size:	New Zealand Wool Board Strong Segment Indicator multiplied by 2,500.
Price Quotations:	Cents per clean kilogram.
Minimum Fluctuations:	1 cent.
Tick Size:	\$ 25.
Contract Value:	The price agreed to by the parties multiplied by 2,500 and expressed as New Zealand dollars.
Mandatory Settlement Value:	The Mandatory Settlement Price quoted by the Clearing House for settlement multiplied by 2,500 and expressed as New Zealand dollars.
Final Trading Day:	The second to last business day of the relevant Settlement Month. Trading ceases at 1500 hours.
Settlement:	Cash settlement with the parties making payment to or receiving from the Clearing House (whichever is applicable) the amount of the difference between the Contract Value and the Mandatory Settlement Value by no later than 1400 hours on the Mandatory Settlement Day.
Mandatory Settlement Day:	The second business day following the Final Trading Day.
Mandatory Settlement Price:	The level of the Underlying Security at the most recent sale prior to, or occurring on, the Final Trading Day as advised by the New Zealand Wool Board to the Clearing House by 0900 hours on the business day following the Final Trading Day rounded upwards or downwards to the nearest cent.
Initial Margin:	\$ 500.
Settlement Months:	Feb/Apr/June/Aug/Oct/Dec. Quoted out to eighteen months.

Source: New Zealand Futures and Options Exchange, *Information Booklet*, 1993.

The term “underlying asset” refers to the actual physical asset traded under the contract. As this study concerns logs and timber, the underlying asset generally referred to will be commodities. However, other types of underlying asset do exist. Historically, commodities were thought to be the only securities that could sustain futures markets (Baer and Woodruff, 1929, and Baer and Saxon, 1949). However, futures contracts have been drawn successfully on many financial instruments, and on indices composed of commodities or financial instruments. More recently, innovation has been successful in developing contracts for trading price risk on insurance and other services, and now even on pollution quota (Figlewski, 1985, D’Arcy and France, 1992, and Niehus and Mann, 1992).

Commodities exist in varying degrees of quality, and therefore it is important to specify the “grade” of the underlying asset, and recognise that traders will deliver the

cheapest possible grade. The New York Cotton Exchange specifies the asset in its orange juice futures contract as:

US Grade A, with Brix value not less than 57 degrees, having a Brix value to acid ratio of not less than 13 to 1 nor more than 19 to 1, with factors of colour and flavour each scoring 37 points of higher and 19 for defects, with a minimum score 94.

The Chicago Mercantile Exchange (CME) in its random length Lumber Futures Contract specifies the asset as:

Each delivery unit shall consist of nominal 2 x 4s of random lengths from 8 feet to 20 feet, grade-stamped Construction and Standard, Standard and better, or # 1 and # 2; however, in no case may the quantity of Standard grade or # 2 exceed 50 percent. Each delivery unit shall be manufactured in California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, or Alberta or British Columbia, Canada, and contain timber produced from and grade-stamped Alpine fir, Englemann spruce, hem-fir, lodgepole pine and/or spruce pine fir.

Historically, it was thought that only one grade could be delivered on a futures contract, and therefore the underlying asset needed to be specified precisely and exist in a totally homogeneous form. Recently, however, contracts have been successfully innovated to allow a number of deliverable grades. The “settlement price” of the contract in these instances is adjusted by way of premia or discounts on a basis grade. The clearest examples exist in financial futures. These are normally easy to define; for example, it is not difficult to specify the grade of a U.S. dollar. However, this is not always the case. The Treasury Note futures contract listed on the Chicago Board of Trade (CBT) is one interesting example. The underlying asset is the long-term U.S. Treasury Note with a maturity of not less than 6.5 years and not greater than 10 years. The exchange applies a formula to calculate the settlement value of the contract depending on the time to maturity at delivery. Methods for calculating premia and discounts are discussed in Part III.

Deciding on the basis grades, and the method of computing premia or discounts, are important balancing decisions. The contract must be wide enough to draw participants for necessary liquidity, yet must not be too wide to allow a number of deliverable grades with vastly differing values. Further, the additional requirement of premia and discounts for non basis grades complicates pricing, and as such, often has the effect of deterring potential hedgers from entering the market.

The “contract size” specifies the number of units in each contract, for example, 2,500 units of the Wool Board Strong Segment Indicator, a designated number of tonnes of wheat, or dollars of face value of a financial instrument. Contract size is also an important balancing decision. If the size is too small, traders will find it too expensive to trade, since trading costs depend on the number of contracts traded. As the contracts are not divisible, if the size is too large, their value may exceed the normal value of the underlying commodity<sup>with</sup> which producers or traders would normally want to hedge or speculate.

The “price quotation” unit is simply the unit in which the contract is specified. For example, the wool contract is quoted in cents per clean kilogram. For the U.S. Dollar futures contract, the price quotation unit is New Zealand dollars per United States dollar. The quotation unit chosen is not necessarily critical, but it should be easily understood and reflect normal marketing practices.

Closely related to the quotation unit is the “minimum price fluctuation”. This is commonly referred to as the “tick size” which is usually the smallest unit of quotation. The value of the tick, or actual minimum fluctuation, may be found by multiplying the tick size by the contract unit size. For example, the minimum price change, or tick value, of the wool contract is \$ 25 (i.e., \$ 0.01 x 2,500).

### **1.2.2 Delivery Terms and the Clearing House**

The contract must indicate a “final trading day”, a “mandatory settlement” or “delivery day”, the “settlement” or “delivery procedure” and a set of “expiration months”. The final trading day may be set in an arbitrary manner, but it is common to use the third Friday, or the second to last business day, of the month.

If settlement is by cash, the mandatory settlement date is also set by an arbitrary procedure, but is normally set at the first business day of the month following the final trading day. In New Zealand the settlement date is usually the second business day following the final trading day.

In the case of certain commodities, expiration months are established with respect to harvest, output, or times of demand. In other situations of smooth supply and demand they are spread throughout the year. The exchange will decide how far into the future

settlement dates will extend, taking into account the likely demand for the contract for those lengths of time.

The value of the contract is outlined in the exchange specifications, and depends on the unit size multiplied by the price agreed on by the parties concerned. At the settlement date the mandatory settlement value of the contract will equate to the unit size multiplied by the settlement price, as quoted by the clearing house. This price may relate to a value determined from a spot market, an index value or via more complicated settlement procedures as determined by the contract specifications. The contract specifications of the wool contract specify that the settlement price is:

The level of the Underlying Security at the most recent sale prior to, or occurring on, the Final Trading Day as advised by the New Zealand Wool Board to the Clearing House by 0900 hours on the business day following the Final Trading Day rounded upwards or downwards to the nearest cent.

Under the cash settlement method, buyers and sellers receive or pay a cash amount reflecting the net accumulated gain or loss. This is calculated as the difference between the selling or buying price of the contract and the mandatory settlement value.

An alternative to the cash settlement method, which is not as yet used in New Zealand, involves the seller making actual delivery of the commodity (or financial instrument), and the buyer accepting delivery. For example, in the case of the U.S. Lumber Futures Contract, delivery is specified as:

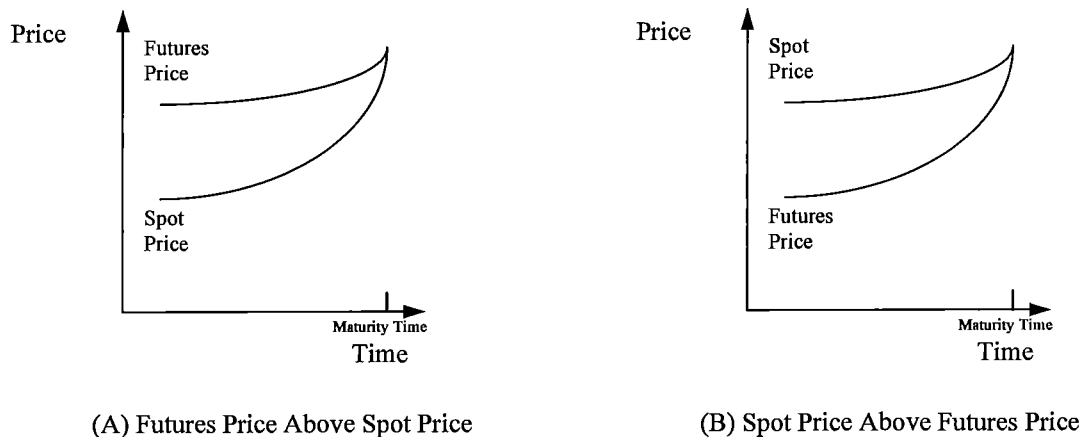
On track and shall either be utilised in double-door boxcars or, at no additional cost to the buyer, each unit shall be individually paper-wrapped and loaded on flatcars. Per delivery of hem-fir in California, Idaho, Montana, Nevada, Oregon, and Washington, and in the province of British Columbia.

The exchange specifies which method is to be used in the contract specifications. If cash settlement is used, the specifications detail how the mandatory settlement value is determined, or if actual delivery is prescribed, they specify which grades are acceptable and where and how delivery may take place.

As futures contracts are fully tradeable, it is common for position holders to reverse their position before maturity by making an equal and opposite transaction to the position held. For example, a previous long position can be liquidated by trading short, the same number of contracts, for the same delivery month. This process is termed "closing out", or "offsetting", and is usually completed in the month of maturity. A very

small percentage of contracts in New Zealand and overseas actually ever run to maturity. It has been suggested that less than one percent of U.S. Lumber Futures Contracts run to maturity (CBT, Verbal Statement, 1994).

**FIGURE 2: RELATIONSHIP BETWEEN FUTURES PRICE AND CASH PRICE AS THE DELIVERY MONTH IS APPROACHED**



Although, few futures contracts actually ever run to maturity, the delivery process is important in establishing the relationship between the cash market price for the commodity and the futures price.<sup>2</sup> The relationship is important because only when the two price series converge at maturity is maximum hedging benefit obtained. The hedger enters the futures market in order to transfer price risk to another party. In doing this the hedger replaces price risk with “basis risk”. Basis risk is defined as the likelihood that cash and futures prices will not move in parallel. If the spread between the cash and futures price is consistent over time, the contract is said to be a perfect hedge, and both price risk and basis risk will be nil. This normally happens because of arbitrage opportunities. Figure 2 illustrates the situation. In (A), the futures price is above the cash price: the two prices will converge as the contract approaches maturity because arbitrageurs will short a futures contract, buy the asset, and make delivery. This will earn a profit equal to the amount by which the futures price exceeds the cash price. As arbitrageurs exploit this opportunity, the futures price will fall to meet a rising asset price.

<sup>2</sup> The cash market is simply the market which trades the underlying asset. This market can be interchangeably referred to as the underlying market, the physical market, or the spot market.

Similarly, arbitrage opportunities provide for the convergence of the two prices when the cash price is above the futures price, as in (B).

When cash settlement is used, the settlement price on the last trading day is the closing cash price of the underlying asset, so the futures price converges to the cash price automatically. However, it is important to note that the closing price selected by the exchange may have been obtained at a time slightly different from the time that traders close out their cash market positions, and therefore an effective small bias can still exist.

### **1.2.3 Margins, Daily Limits, Marking-to-Market, and the Clearing House**

The clearing house is critical to the successful operation of the market because it provides futures contracts with integrity. The clearing house carries out the function of matching and processing daily orders. It registers and matches each buy order, the trader going long, and each sell order, the trader going short. When the orders are matched, the clearing house imposes itself on the other side of each and every transaction thereby imposing an impersonal element on the market. That is, the buyer has a contractual obligation to accept delivery from the clearing house, rather than the seller, and the seller has a contractual obligation to deliver to the clearing house, rather than the buyer. This provides the market with integrity. In the absence of the clearing house, each trader would be responsible to each other trader. If one party defaulted, the other would be left with a worthless claim. However, once the clearing house imposes itself as an intermediary, all contracts are guaranteed, as it promises the buyer that the seller will perform, and vice-versa. This concept also allows transferability of the contract, or position reversal, without reference to the original contracting party.

The clearing house does not incur any risk when guaranteeing futures contracts because of the “marking-to-market” system which provides for the daily settlement of margin accounts.<sup>3</sup> Buyers and sellers are required to post margins with the clearing house.<sup>4</sup> The marking-to-market system operated by the clearing house then reduces, or

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3 In their entire time of operation, the clearing corporation for the CBT and the International Monetary Exchange have not had a single incident of financial loss.

4 In reality, margins are deposited with the broker who passes them on to the clearing house

increases, the balance of this margin account in the daily settlement procedure. In this way, losses on open positions are not paper losses, but are real and paid each day through the fluctuating balance of the margin account. Each open position is valued using the settlement price, and losses from positions adversely affected by price movements are passed on to traders who have made profits in that day. Since the clearing house does not hold a position itself, the daily profits of traders will always equal the daily losses since there must be an equal number of short holders of open positions as there are of long. To ensure that the balance in the margin account never becomes negative, a maintenance margin, which is set lower than the initial margin, is set. The maximum price movement set by the exchange ensures that on any one day, the trader can never lose more than the entire amount of the maintenance margin. The maximum price movement is set in accordance with past history of price volatility, and then the margins are set. Because volatility changes over time, the size of the initial margin required will be revised as necessary. If the balance of a decreasing initial margin falls below the level of the maintenance margin additional funds will be required. This is called a variation margin. If the variation margin is not deposited immediately, the clearing house will liquidate the position of the trader. Therefore, the clearing house always has funds to make daily transfers, and default risk is small.

The clearing house is also responsible for settlement. It specifies and enacts all settlement procedures. The clearing house also sets the mandatory settlement price on the final trading day which is used to value all matured positions. Cash settlement is then paid.

For actual delivery, notification of intention to deliver is normally required. The clearing house then matches the long and short positions, and notifies the parties to make or take delivery by a particular time. The delivery process is then completed by the short presenting to the clearing house, or directly to the long, the required product, and receiving payment for that product at the appropriate futures price.

### **1.3 The Evolution of the Futures Market**

The development of futures trading was evolutionary and no specific date can be attached to its beginning. Examples of organised futurity trading can be traced as far back as the 1600s. Landowners and feudal lords of Imperial Japan received rents from



their tenants in the form of a share of each year's rice harvest. As expected, their rental income was irregular and subject to uncontrollable factors, seasonal and otherwise. However, their money driven economy required them to have cash on hand. So surplus rice was often shipped to principal cities where it could be stored and sold as required. When rice stores were insufficient to satisfy these immediate cash sales, landlords sold tickets (warehouse receipts) against goods stored in rural or urban warehouses. Consumers purchased these tickets, as it enabled them to plan for their future requirements by qualifying the price for which goods would effectively be transferred, and so removing the impact of negative price fluctuations — price risk.

Eventually, rice tickets became the generally accepted method to facilitate business. In fact, during the late seventeenth century trading on the Japanese Dojima rice market could only be facilitated by trading rice tickets. The market, termed the *cho-ai-mai-kaisho*, had a number of features which reflect modern futures markets:

1. The contract duration term was limited.
2. A basic grade for the contract was determined.
3. All contracts were standardised.
4. Contracts could not be rolled over into the next period.
5. All trades were cleared through what was effectively a clearing house.
6. All traders had to establish a line of credit with the clearing house.

Disallowing an underlying market and facilitating business only through futures trading is a prohibition which differs from modern futures trading. It caused the futures cash-price relationship to function improperly which caused erratic price movement and subsequently the Imperial Government suspended trading in 1869. However, the market was reintroduced two years later after volatility in the cash market reached chaotic proportions. Significantly, physical delivery of the underlying commodity was allowed, which established the required nexus between the cash and futures markets.

In the United States the major commodity exchanges were established in Chicago and New York for location reasons. New York is located on major ocean shipping routes, and is therefore well positioned for international trade. Chicago grew rapidly from its establishment in 1833 because it was situated at the hub of interior production

lands, and because of the successive completion of canal and rail routes which provided cheap transportation between areas.<sup>5</sup>

Although the canals expanded the size of the area from which it was economical to ship to Chicago, and hence effectively expanded the liquidity of the cash market, these canals could only be used seasonally. The canals were closed in winter, but unfortunately this was the most reliable time for grain to be transported by road from farms to the canal system. Consequently, corncribs and grain elevators emerged along the canal banks and accepted grain from farmers who delivered during winter. Corncribs held this stock until spring before delivering it to Chicago.

As dealers bought stock in the winter, and did not on-sell it until spring, they went to Chicago to find buyers on a forward basis. Subsequently, "time contracts" arose, the first of these simply being verbal agreements or exchanges of memorandum. On 13 March 1851 the first time contract was born on the CBT. The contract called for the delivery of 3,000 bushels of corn in June at a price 1 cent per bushel below the 13 March price. This specification illustrates the informality of the agreement — only quantity, time and price were detailed.

Soon after, some contracts required that a proportion of the delivery price be paid at the contracting date. But the basic contract remained personal, and each party relied principally on the integrity of the other for fulfilment. However, an element of contract specifications similar to modern futures trading was formed.

Commodities grown in different parts of the United States differed in grade and weight, so "to arrive" contracts were not always suitable. This often resulted in delays and litigation in settlement, and discouraged site-unseen trading. In response, grain trading progressively became more regularised. In 1848, the CBT was organised as a Merchants' association to centralise grain trading and provisions. In 1854, it introduced the practice of buying and selling by weight, rather than measured bushels. In 1856, standard grades of wheat for trading were prescribed, and a minimum weight test for the measurement of grain was adopted. The following year, an inspection and weighting

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<sup>5</sup> In 1848, the Michigan-Illinois Canal opened and provided cheap transportation from the fertile lands along the Illinois river to Chicago. This river access substantially lowered the cost of transportation, and as a result the size of several markets grew. For example, trade in corn grew from 67,000 bushels in 1847 to more than 3 million in 1851.

system was created. Finally, in 1859 the CBT was empowered by Illinois state legislation to establish and enforce grain standards.

From this logical beginning, standardisation of deliverable grades and contract size, with inspection by exchange-recognised authorities, developed. These developments promoted contract homogeneity, and are essential features of modern futures trading. The acceptance of grading standards also permitted the development of the warehouse receipt to convey grain title and to be used as collateral in financing grain transactions.

Despite the increasing business on the forward market, rules governing this form of trading took some time to appear. It was not until 1863 that rules were adopted according to which members could be suspended if they did not meet their contractual obligations. However, these were not sufficient and in 1865 a margin provision was installed. Margin deposits were not a requirement, but could be requested by either party to a maximum value of 10 per cent of the asset value whether it was being bought or sold. A lesser amount would normally be called, but if it was deemed necessary an adjustment would be requested — the first, variation margin. The margin was deposited at a mutually agreeable place.

From 13 October 1865 forward contracts included accepted standards of grade, common sizes and delivery times, and were enforceable among members of the association. Margin requirements were not enforceable, but by their existence, they provided additional contract security. Homogeneity of contracts was relatively high, and forward contracting was firmly established. Some writers on futures market evolution claim that at this stage formal futures existed.

Other authors consider that the final element necessary to create the futures market was the development of the principle of offset, which enables an individual to reverse a contractual obligation with ease. Traders recognised that it was often necessary to reverse a position if their situation changed — for example, if they did not receive as much grain as expected, and therefore they had pre-sold too much. Consequently, they would try to on sell their forward contracts. This would often be to speculators who were willing to take on price risk.

The principal of offset developed in two stages. First, in 1883 the first clearing house evolved. It used the ring settlement method to carry out its only function of settling daily accounts. Second, in 1891 at the Minneapolis Grain Exchange, the first complete clearing house was developed. In addition to daily accounting responsibilities, it imposed itself between buyers and sellers in the exchange to become the third party to all transactions.

Prior to the first ring settlement method, if traders re-sold a forward contract they had to wait for the original contract to be settled between the new party and original other party, before they would receive or pay their difference. Further, if either of these two parties defaulted on their obligation they would become involved in the dispute. The ring settlement procedure provided for the settlement of price differences on contract purchases and sales, and thereby allowed traders to exit the market, without needing to wait for final settlement of the original contract before they could settle their accounts.

In 1883, ring settlement methods were formalised at the CBT with the introduction of the first clearing house. The objective of the clearing house was to facilitate the offsetting of trades between brokers without waiting for customers to close them. Under this system, traders would settle their positions each day with their respective broker, who would maintain internal records of accounts. Any difference between brokers would then be settled through the clearing house. This system remained in effect at the CBT until the 1920s.

In 1891, the Minneapolis Grain Exchange implemented a clearing house that not only had the responsibility of settling daily accounts, but also resumed a third party position to all transactions on the exchange. This reflects the complete clearing house facilities used today.

The development of clearing house facilities, accounting and offsetting, produced futures markets from forward markets trading contracts with standardised specifications. While performance of a forward contract with individual terms and conditions continues to rely on the integrity of the parties, futures markets in contrast are uniform and impersonal. Their integrity relies on the establishment of the clearing house and the marking-to-market system.

Although in the majority of instances futures trading evolved from forward markets, it is not necessary that a forward market exist before a futures market can be established. This has been demonstrated by the success of the plywood futures contract in the United States which was not preceded by a forward market.

Futures markets have not replaced either cash or forward markets. Each of these remains uniquely valuable for the marketing, processing and distribution of commodities.

This discussion follows Peck (1985, pp. 1-13). However, the evolution of wheat futures at the CBT was paralleled by separate wheat futures markets emerging at other major terminal markets, including Kansas City, Minneapolis, New York, Duluth, Milwaukee, St. Louis, and Omaha. Further, some essential developments did not take place at Chicago. The Minneapolis Grain Exchange accepts credit for the innovation of the clearing house offset. Remarkably, there was almost parallel, and apparently unrelated, development of a cotton futures market at the New York Cotton Exchange.<sup>6</sup>

#### **1.4 The Evolution of the New Zealand Futures and Options Exchange**

Layton (1987) describes how futures trading began in New Zealand in 1980 with the introduction of a telephone conference call link, so that the London based crossbred wool contract could be traded. During the 1970s wool exporters increasingly became active as principle traders, rather than commission brokers. They sold the wool in the international market by forward contract which was usually denominated in a currency other than New Zealand dollars. Although currency risk could be hedged by a forward foreign exchange contract, the exporters faced the risk of the New Zealand dollar wool prices fluctuating from when the wool was purchased at auction in New Zealand and when it was sold in the international market.

The conference call network enabled trading to take place among brokers who were scattered throughout New Zealand, and who were unable to establish offices in one centre. Being a London based future, the contract was able to be traded in the two time

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<sup>6</sup> Unfortunately, few analyses exist of the history of these various exchanges. Irwin (1954) completes a suggestive analysis of the experience of both the Chicago Board of Trade and the New York Cotton Exchange. Peck (1985) provides the most detailed account of the development of the Chicago Board of Trade futures market.

zones of New Zealand and London. These two specialty features show the innovative nature of futures trading in New Zealand that has existed from the beginning.

This trading provided the impetus for the formal establishment of the futures exchange. Users of the wool contract recognised the benefits of futures trading and sought to develop a market for other useful contracts. They considered that financial futures, which at the time were a major growth area in international markets, could provide significant benefit because of the liberalisation process that began in New Zealand during 1984. The government of the day chose to reduce day-to-day involvement in the economy, and through extensive privatisation and market liberalisation they assumed a free and open market economy. This resulted in many underlying financial securities developing significant price volatility. Finally, the abolition of foreign exchange controls, and deregulation of the banking industry, provided the environment for the development of a successful futures exchange.

The New Zealand Futures and Options Exchange (NZFOE) commenced trading in January 1985 with a foreign exchange contract for the U.S. dollar and the London based wool contract. The wool contract ceased trading in London at that time. In May 1985 a 90-day prime commercial paper interest rate contract was introduced, and in February 1986 the exchange provided a five-year government stock interest contract. In July of that year a wheat contract was added, but due to insufficient trading this was suspended in March 1987. At this time the 90-day interest rate contract was also suspended, largely because it was superseded by a bank bills contract, introduced in December 1986.

The exchange currently has seven futures contracts trading, including the newly listed Air New Zealand contract which began trading in 1994. The exchange also provides seven listed options on commonly traded equities, three options on selected financial futures and one option on the NZSE-40 index.

The third innovation of the NZFOE was the Automated Trading System (ATS) which has led automation in futures markets around the world.<sup>7</sup> As New Zealand's

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7 The London Futures and Options Exchange (London Fox) has used Mark II of the system since July 1988 to provide an enhanced dealing facility, and multi-currency settlement capacity. The system is also used by the London International Financial Futures Exchange (LIFFE).

three main centres did not have enough commercial activity to support a trading floor each, the advent of the computer-based electronic dealing facility enabled the exchange's 43 New Zealand members to facilitate trading although they are located throughout the country. Because of the ATS's geographical capabilities, 18 Australian members were able to join the organisation in February 1984. The electronic exchange, developed by International Commodities Clearing House Ltd, also provided for relatively low set-up costs, and fast and accurate price dissemination at low cost. The system utilises windows technology which allows cross referencing of market information. The ATS functions by matching buy and sell orders entered by price, and in chronological order, and can easily be adapted to 24 hour trading.<sup>8</sup>

Dealers on the exchange are classified as either Principal Trader, Public Broker, or Introducing Broker. In order for a dealer to trade on their own account they must possess a "trading permit" which is issued only to Principal Traders and Public Brokers who are guaranteed by a member of the clearing house. Clients may trade on the exchange only through Public Brokers and Introducing Brokers.

The Sydney Futures Exchange (SFE) bought the business assets of the NZFOE in February 1992, and is now the sole shareholder. The SFE is the ninth largest futures market in the world, trading 70,000 contracts on average every day, compared with NZFOE's previous daily average contract volume of just 3,000. The move has been successful, as the additional brokers it drew to the market have enhanced liquidity, and the new record is now set at 16,000 contracts in one day. As an additional result of the ownership change, the Sydney Futures Exchange Clearing House assumed the role of clearing which was previously undertaken by the International Commodities Clearing House Ltd.

### **1.5 Conclusion**

Futures markets trade contracts with standardized specifications for the purchase or sale of commodities, or financial instruments, at predetermined delivery dates in the future, at prices agreed upon when the contract is entered. The specifications detail the

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<sup>8</sup> Presently, the exchange holds additional trading hours when important economic announcements are imminent, particularly when government budgets are announced.

quality of the underlying asset (the physical asset which the futures contract is traded against), unit size, price quotations, minimum fluctuations, contract value, mandatory settlement value, final trading day, settlement method (which can be by cash adjustment or actual delivery), mandatory settlement price, tick size, initial margin, and settlement months. Although all specifications are important, the settlement method is a particularly significant decision because it determines the relationship between the futures and cash market prices.

The exchange determines the contract specifications and administers the operations of the clearing house, which is essential because it adds integrity to the market by:

- matching and processing all daily orders,
- imposing itself on the market, by assuming the other side of each and every transaction,
- settling daily margin accounts of traders using the marking-to-market system, and
- being responsible for the settlement of maturing positions.

Use of a futures contract is not limited to those who actively produce or consume the specific underlying commodity, but can be extended to those who are active in the markets of products which are closely related by price, and to those who wish to speculate on the price of the commodity.

Futurity trading can be traced as far back as the 1600s to Imperial Japan. However, modern futures trading evolved from forward contracting (“time contracts”) relating to wheat in the U.S. from the late 1800s.

Futures trading began in New Zealand in 1980 with the introduction of a telephone conference call so that the London based crossbred wool contract could be traded. The NZFOE commenced trading in 1985, and now trades seven futures contracts. The exchange uses an automated trading system which has led automation in futures markets around the world.



## **2. The Economic Roles of Futures Markets**

### **2.1 Introduction**

Commodity exchanges around the world in cash, forward, and futures markets are important institutions for the facilitation of free and open trade. Their existence facilitates the marketing and distribution of many basic commodities for producers, and for those who merchandise commodities from raw materials to finished consumables.

Specifically, futures markets provide those in the commodity trade with hedging opportunities so that they may minimise price risk, and they also reflect all available price information. This enables processors to concentrate on producing output in the most efficient and effective manner for consumer markets. Thus, the functions of the futures market tend to provide for better allocation of resources in society.

### **2.2 Overview of the Economic Roles**

Potential users of futures contracts are often deceived in thinking that futures are a new investment vehicle with the primary purpose of profit speculation. This is not true. The main reason for their existence is the fact that prices of commodities fluctuate, and producers and consumers of these commodities wish to avoid the uncertainty that this fluctuation brings. This can be seen from the evolution of futures. Ideally, buyers like to know, in advance, how much they will be required to pay for a certain commodity, while sellers like to know how much they will receive for their production. The futures market operates to bring buyers and sellers together to generate an agreed price for which commodities will change hands at some future determined time.

The essential role of the futures market is to provide protection, for producers and consumers, over prices to be received, or paid, for a commodity at some later date. This results in a two pronged economic role of the market:

1. The provision of hedging or insurance facilities for producers and consumers, and
2. The provision of price discovery or forecasted future prices.

These two functions provide for the establishment of:

1. More accurate allocation of societies resources, and
2. An investment facility.

The first function of the futures market, the provision of hedging, or insurance facilities, provides risk management for producers and consumers. Fundamentally, the futures market provides an efficient arena for the trading of price risks — either between parties who wish to avoid them, but have opposite exposures to the movement of prices, or between those who wish to avoid them and speculators who are willing to bear them. Often potential users of the futures market, with respect to hedging facilities, hold a mistaken view that the market is a place where hedgers pass risk on to speculators who are willing to bear that risk and reap large rewards for doing so. This is incorrect. It is a place where hedgers who fear a change in price can get together with hedgers who fear an opposite change in price, and establish an effective mutual price insurance agreement. However, speculators are necessary to add liquidity to the market. As such, the demand for futures contracts comes from both speculators and hedgers.

It is with respect to the second function of the market, the provision of information about future prices, or more fundamentally supply and demand, that speculators' role in the market is of great importance. As with any market, the futures market provides monetary rewards for those who convey accurate, and hence economically useful, timely information, and monetary penalties for those whose information is inaccurate or untimely. Clearly, producers and consumers will have closer alignment with the sources of accurate and timely information, but the nature of speculation results in the expending of resources to draw upon available information, and to analyse this information to produce accurate forecasts of future prices. All participants benefit from speculators' participation because prices in the futures market reflect more accurate price forecasts. This allows producers and consumers to plan better resource allocation. Producers know the prices their investment will return, and so can accurately budget for revenues and conclude optimal investment strategies. Both final, and value adding, consumers can accurately budget for costs that they will incur at a significantly earlier time than these costs will be recognised. Arbitraders can allocate storable commodities between periods knowing future prices and the cost of storage.

Finally, because investors who pass on correct information may derive profits, the futures market provides another type of investment vehicle. Further, because less cash

outlay is necessary to derive an equivalent physical market exposure, the leverage that the market allows stimulates the gathering of information about future supply and demand, which aids the success of the aforementioned benefits of the market.

### **2.3 The Theory of Futures Markets**

Futures markets clearly evolved out of a need to reduce price risk. Traditional theory has segregated the participants of futures markets into two distinct factions — hedgers and speculators. Hedgers are defined as those traders who enter the futures market with a spot market commitment in an adjunct commercial activity, and hence a spot market price risk, and by dealing they make their position certain by transferring their price risk to another party. Speculators are defined as those who restrict their activities to futures trading alone, and they enter the market in the hope of making a profit from bringing superior knowledge to the market.<sup>9</sup>

#### **2.3.1 Hedging in the Commodity Futures Market**

If the input or selling price of a commodity changes in a negative manner, the effect on business profits and investment worth can be disastrous. The risk of this occurring is commonly termed "price risk". Most holders of inventory in production marketing systems are exposed to this risk. The futures market enables traders to enter an efficient arena to trade this price risk. By trading a futures contract hedgers alter their merchandising structure by substituting a futures contract, which is effective immediately, for a need for a merchandising contract in the cash market in the future. Therefore, the hedger has a zero ownership position in the commodity, and will not be exposed to price movements in the future. This situation may be shown mathematically. If a position was left unhedged, a purchase of a commodity on the spot market at  $t_0$  for price  $s_0$ , and a corresponding sale at  $t_1$  for price  $s_1$  would yield profit of:

$$p = s_1 - s_0 \qquad p \geq 0 \text{ or } P \leq 0$$

If the position was hedged with the purchase of a futures contract at  $t_0$  for price  $f_0$ , and then this position was offset with a sale on the spot market, the return would be:

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<sup>9</sup> Clearly, this is an oversimplification of the real world of futures, but for the purposes of analysis it is a useful distinction.

$$p = (s_1 - s_0) - (f_1 - f_0) \quad p \geq 0 \text{ or } p \leq 0$$

In the hedge described above, the quantity of futures sold is exactly equal to the quantity of the underlying commodity owned by the trader. This is termed a “pure hedge”, and under traditional futures theory such a trader will always hedge their cash market position, even if the spot price is expected to rise because a pure hedger is assumed not to rely on expectations, or alternatively, not to have any expectations.

Although the profit from the trade as mathematically described above can be above or below zero, it will be very small if the difference between  $s$  and  $f$  remains constant. However, a short hedger (one who is long in the cash market) makes a profit if backwardation increases. Backwardation is a futures term used to describe a situation where  $s > f$ . Short hedgers will also profit if contango declines. Contango is a futures term describing a situation where  $f > s$ .<sup>10</sup>

When hedgers enter the futures market they replace their price risk with basis risk: the likelihood that spot and futures prices will not move in parallel. If the spread between the spot and futures is consistent over time the contract is said to be a perfect hedge and both price risk and basis risk will be nil. In theory, the futures and cash markets move in parallel, and basis risk is minimal, because the same supply and demand forces effect both markets. However, caution should be exercised in hedging operations, because prices in the cash market, and the designated futures months, do not always move in the same direction over short periods of time, or by exactly the same amount over the longer run. Further, prices of different species, and grades within the commodity group, do not necessarily change by the same proportions as a futures contract.<sup>11</sup> Similarly, prices in smaller geographical areas may not move in parallel with a futures contract listed at the major centralised exchanges.

Quantitative studies by Working (1953) have challenged the simple risk-avoidance concept of hedging. Later, Working (1962) developed a multi-purpose concept of hedging by describing five different categories of hedgers, whose hedging

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10 The long hedgers' situation will be the reverse. They will make a profit if backwardation declines, or if contango increases. In this way the long hedgers' loss is the short hedgers' gain.

11 For example, the price of douglas fir might increase faster in reaction to increased world timber demand than the price of radiata pine.

decisions are based on a variety of reasons according to different circumstances. These categories have been challenged<sup>12</sup> but remain accepted by the large majority of the academic community.

Working (1953, p. 546) provided an all-encompassing definition of hedging:

Hedging in futures consists of making a *contract to buy or sell on standard terms, established and supervised by a commodity exchange, as temporary substitute for an intended latter contract to buy and sell on other terms*. Then the hedger seeks to make the second purchase or sale, perhaps several months latter, on terms that suit him better than those of the standard [futures] contract.

1: *"Carrying-charge hedging* is done in connection with the holding of commodity stocks for direct profit from storage (rather than merely to facilitate the operation of producing or merchandising business)." The hedger in this circumstance is faced with the decision of anticipating changes in the basis, rather than changes in the price level; so carrying-charge hedging is restricted to merchants who are fairly knowledgeable of price differences between the various species, specifications, and locations of the commodity: "The decision that he makes is not primarily whether to hedge or not, but whether to store or not."<sup>13</sup>

Peck (1985, p. 14) terms this "arbitrage hedging" and asserts that it is the "most common" type of hedging. Peck maintains that arbitrage hedging is done to profit from a predictable difference in price between the cash and futures market. For agricultural commodities, storage space will be required, and so the arbitrager must account for the cost of carrying the commodity, in addition to giving consideration to changes in the basis.

2: *Operational hedging* is the use of futures as a substitute for an actual purchase or sale of a commodity (normally for a very short period) which allows the firm time to assemble the desired commodity on more suitable terms. Peck considers

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12 Johnson (1960, p. 142) stated:

In general, hedging activities appear to be motivated by the desire to reduce risk as described by traditional theory but levels of inventory held appear to be not independent of expected profits as emphasised by Working. Furthermore, that an individual may hold a mix of hedged and speculative positions in response to his expectations concerning absolute price changes is a procedure not well explained in either traditional theory or in Working.

13 Working examined evidence of the relationship between levels of basis over time in the wheat market, and found that currently observed basis predicted as much as 95 % of the subsequent change in basis.

that futures markets are very effective at this function because they have much higher liquidity than underlying spot markets. High liquidity means that large commercial transactions can be consummated with minimal effect on prices. The futures market has much greater liquidity because it is a large centralised market (as apposed to smaller regional cash markets), because all traders are trading standardised contracts, and the clearing house guarantees the performance of every trade. This allows individual firms to spend more resources searching for specific grades, or qualities, in suitable locations, and at appropriate times.

However, Working considers that because hedgers are initiated and liquidated over very short intervals, the reduction in risk is often minimal since parallel price movements of the cash and futures markets usually do not exist over such short intervals. For this reason, Working believes that the practice is not widespread.

3: "*Selective hedging* is the hedging of commodity stocks under a practice of hedging and not hedging according to price expectations." This differs from the definition of traditional hedging which assumes that hedgers have no price expectations or do not rely on any expectations that they may have. Hedges are placed when price declines are anticipated, so the purpose of hedging is not strictly risk reduction, but avoidance of major losses due to price decline. Working believes that hedging used as a regular component of business operation is predominant only in the wheat and cotton trades. Selective hedging characterises most of the short hedging in other futures markets. The smaller futures markets have a prevalence of selective hedging, because there is not enough speculation, or liquidity, to support regular hedging, and potential hedgers feel they can make better judgements on price levels rather than basis.

4: "*Anticipatory hedging*, which also is ordinarily guided by price expectations, differs from selective hedging in that the hedging contract is not matched by either an equivalent stock of goods or a formal merchandising commitment that it may be said to offset." Manufacturers who use this type of hedging buy futures contracts to cover future raw material requirements, either to take advantage of present prices or to avoid building excessive storage facilities, and thus they release capital for more productive use. Producers sell futures, in lieu of forward sale commitments, before actual production. Working believes that most long hedging is categorised as anticipatory hedging for the simple reason that an anticipated purchase or sale of a commodity

cannot be carried out in the cash market today. An unavailable study by Leuthold and Tomek (1979) quoted by Peck (1985, p. 20) concluded that anticipatory hedges, using some price forecasting or break-even decision criteria, generally provide higher, and less variable, returns than alternative cash market sales.

5: "Pure risk-avoidance hedging, though unimportant or virtually non-existent in modern business practice, may have played a significant part in the early history of futures trading." Although this is a rather strong statement by Working, it is consistent with his position that hedging is done for a variety of reasons, the principal one being to reduce major losses, rather than reduce risk in the strict sense of the term.

### ***2.3.1.1 The Role and Effects of Futures Markets in Commodity Storage***

A futures market provides simultaneous quotations of value for a commodity, deliverable at successive future dates. This process enhances resource allocation, because firms are able to make an informed storage decision. That is, they are better informed in their decision whether to sell production in the cash market now, or store it for later sale. As a result, the theory of futures can be considered a theory of inter-temporal price relations, and since futures aid the allocation of society's resources they enhance social welfare.

The difference between two simultaneously quoted prices, for successive delivery dates, for a storable commodity will reflect the costs of storage when supplies are ample. Arbitrage will ensure that the difference in price between two futures contracts is no more or less than the costs of storage.<sup>14</sup> Costs of storage include finance costs in addition to physical storage costs, which are likely to consist of insurance and warehousing.

This concept is important to the realization that cash prices react to changes in futures prices. If supply information indicates that in the future a bumper crop is expected, the current futures price will be depressed.<sup>15</sup> Similarly, an expected shortage

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14 Clearly, if the difference widened beyond costs, arbitrageurs could buy a nearby future, say May, and sell a distant one, say August. In May they would accept and finance the commodity and re-deliver it in August.

15 Empirical studies, by Irwin (1954) and Working (1949) show that a change in the basis discourages stock carrying and leads to stocks being realised for current consumption. This depresses current cash prices.

in the future would raise future prices and thus make the holding of stocks more favourable, with an accompanying reduction in current consumption and thus higher cash prices.

The relationship between prices for futures contracts with different delivery dates for storable agricultural commodities was first investigated by Working (1949). He showed that the difference between two simultaneously quoted prices for wheat with different delivery times was directly related to the level of private or free stocks of wheat available at the nearby delivery date. From this he was able to conclude that the price difference is a market determined price for storage.

When supplies are large, the price of storage as determined by the market will approximate the total cost of storage, and merchants will be able to earn a fair return on stored supplies. As current supplies decrease, the market supply for storage decreases relative to the full costs of storage. In fact, as current supplies decrease, the market supply for storage may even become negative because of the convenience yield effect. As scarcity increases, owners of limited levels of stock place more and more value on the flexibility the ownership offers them in their business operations. The convenience that this ownership provides can be represented by a convenience yield curve, and the degree of benefit will increase as available market stocks decrease (Wright and Williams, 1989).

The convenience yield is particularly important with respect to seasonal commodities. Convenience rises as supplies decrease, and because scarcity is relative there is no upper limit on the benefit that the owner may derive. Similarly, as supply decreases, convenience increases and the net marginal costs of storage decline, so there is no lower limit on the possible negative difference between futures prices for a seasonal, storable agricultural product. These negative prices for storage are called inverse carrying charges.

In the absence of a futures market, the price difference which is important in storage decisions is that difference between the current cash market and the expected future spot market — if prices are expected to increase, this will encourage arbitragers to carry more stocks than if they were not. However, the storage returns will be speculative since they depend on events that will occur after the storage decision has



been made. If a futures market exists then the storage decision can be made with certainty if the arbitrageur chooses to use the hedging facilities the market offers. In conclusion, because of the forward pricing ability of futures markets for storable commodities they also have an allocative role.<sup>16</sup>

### *2.3.1.2 Speculative Participation in the Commodity Futures Market*

Conceptually, a futures market could exist with trading restricted (internalised) to those with a legitimate hedging interest. If all firms in the production chain of harvesting, processing, marketing, and consumption participated, price risks associated with each stage could be offset and eliminated.<sup>17</sup> However, since the futures market requires that for every buyer, there be a seller, long hedging interest ( $H_l$ ) would need to equal short hedging interest ( $H_s$ ):

$$H_l = H_s$$

Just as firms' individual purchase or sale decisions in the underlying cash market rarely coincide — which makes this market relatively illiquid — a futures market consisting only of hedgers would probably also be relatively illiquid. There is no justification as to why firms' futures transactions would be more likely to coincide than their cash market transactions.

Speculators are futures traders who enter the market with no other commercial activities. Their sole objective is to profit from the speculation of price changes. But, by entering the market, they absorb the frequently unbalanced demands of hedging traders. In this way  $H_l$  does not need to equal  $H_s$ ; instead:

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16 It is important to note that this section has a focus emphasising storable commodities, as that relates best to the forestry industry in New Zealand. Conceptually, the role of futures markets for non-storable commodities in determining pricing is simpler. Because there is no storage, the futures prices simply reflect anticipated supply and demand. However, with most agricultural products it is necessary to consider the lag between planning and realisation of production in the subsequent crop year.

In the absence of a futures market, when producers make their production decisions they must form an independent expectation of what prices will be at harvest. In this situation resources will be mis-allocated to the extent that producers' forecasts are retrospective and not prospective. The resource mis-allocation amounts to considerable social losses.

As a conclusion, where the futures market provides both an allocative and forward pricing role for storable commodities, it provides only a forward pricing role for non-storable commodities.

17 For example, a seller at the harvesting stage would be able to trade with a buyer at the processing stage.

$$H_l = H_s + S_{\text{Net}}$$

Of course speculators can hold both long and short positions so:

$$H_l = S_l = H_s + S_s$$

The imbalance of hedgers' demands can occur in three dimensions, firstly because of timing differences between order placements that occur within each day's trading. In this case the speculators, whose participation is termed market making, or scalping, add liquidity to the market by allowing hedgers' transactions to be effected immediately rather than having them wait for another hedger to arrive at the market who wishes to effect an opposite position. Market makers stand in the market ready to buy or sell at a price no more than one tick above or below the last quoted price<sup>18</sup> so they provide the bid-ask spread which provides liquidity (Melamed, 1981).

Market makers therefore trade large volumes during daily trading, but seldom carry an open position overnight. The amount of their activity is then based on their daily trading volume, rather than their open positions. They make money by effecting many orders, and taking the spread on each transaction.<sup>19</sup> They do not attempt to profit from holding open positions (Melamed, 1981).

Although it is commonly held that market makers constitute the largest class of speculators (Peck, 1985), a comparatively small number of studies exist which consider the returns from market making. Working (1967) estimated a gross return of \$ 4.64 per contract for resident market makers trading in the cotton futures market. Silber (1984) found gross returns of \$ 10.56 per contract for resident market makers trading the contract based on the New York Stock Exchange composite stock index on the New York Futures and Options Exchange.<sup>20</sup> In both studies, the average return per contract was found to be less than the tick value. In addition, Silber concluded that trades held open for less than three minutes were consistently profitable, but trades held open for a

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18 This is the most competitive case. More than one tick differences may be used.

19 The spread is the difference between the bid and ask price.

20 It should be noted that this return is less than the minimum price change and, as they are gross returns, do not take into account the necessary transaction costs.

longer duration were on average unprofitable. This evidence is conclusive — the longer a position is open, the greater the possibility of a real price change and chance of a loss. Profitable scalpers derive their profits from skilfully accommodating the very short term orders arriving at the market. More recently, Kuserk and Locke (1993) found the same conclusion in a study of market makers in a number of different futures markets (including foreign exchange, indexes, and commodities). They, however, assessed the income of market makers on the basis of daily income, rather than income per trade. They found market makers' gross median daily income to range from \$ 240 to \$ 1025. The median daily income among the agricultural futures was \$ 431, and among financial and index futures was \$ 683. Taken on this basis, the profits achievable from market making appear to be substantially superior.

Although market makers technically exist to absorb temporary imbalances in timing orders, the concept is somewhat arbitrary, because there is no way to distinguish between orders — inevitably market makers must trade with other speculators as well as hedgers. Although there is no real way to attain information on the composition of trading, a survey quoted by Peck (1985, p. 30) estimated that 90 - 95 % of trading volume in large markets is speculative, most of which is market making. In smaller markets the speculative proportion is likely to be around 40 - 60 % (CME, verbal comment, 1994). As a result of the large proportions of speculative trading, the activities of market makers attract considerable amounts of scepticism.

The second imbalance of hedgers' demands occurs from a difference between the total number of buyers and sellers. In this case the speculators engage in position trading whereby they absorb the imbalance between the aggregate buyers and sellers of futures contracts over the longer time frame.

Although market makers account for a large majority of trading volume, position traders are the most frequently identified form of speculation simply because they are the other large proportion of traders, other than hedgers, which hold open positions. Peck (1985) estimates that they hold 20-30 percent of the open interest in the grain markets.

They attempt to profit from holding their positions over time by using fundamental analysis and technical trading. Fundamental analysis essentially involves

the analysis of supply and demand forces to forecast future movements, and technical analysis involves the analysis of historical price patterns in an attempt to predict future changes.

When speculators absorb the imbalance of commercial positions in the futures market they assume the risk of such positions. Because the ideology that risk should be rewarded is fundamental to economics, it is often asserted that speculators should extract a risk premium for holding positions. This view was first developed by Keynes (1930, pp. 135-144) in his theory of “normal backwardation” and was later upheld by Hicks (1946, pp. 135-142). Although the concept has intuitive appeal, several latter empirical studies have challenged the concept.

At the time Keynes proposed his view, commercial users were mostly net short on futures, and therefore position trading speculators had to be net long so that all positions were paired. Keynes argued that the only way position traders would be induced to enter the futures market in a net long position would be if futures prices were biased downward, rising on average over the life of the contract so as to ensure a return. “Normal backwardation” is the difference between the expected cash price in the future and the price of that futures contract now, and is therefore the premium the hedger pays the speculator for taking his price risks. Under Keynes’s theory, if short hedging exceeds long hedging, we expect that in the long run speculators would gain by maintaining a long position.

Hicks (1946, p. 138) affirms Keynes’s idea of normal backwardation as the price which hedgers pay speculators to avoid the risk of price fall; and, regards it as “the cost of the coordination [of plans] achieved by forward trading” (pp. 138-9). He does not however, make substantial alterations to the theory, nor make some of the assumptions more explicit.

Houthaker (1957, pp. 143-151) supported the proposition of Keynes and Hick in an empirical work estimating the profits and losses of futures market participants during the periods 1937-1940 and 1946-1952. He concluded that:

1. Large hedgers made losses in all commodities.
2. Small traders made losses in corn and wheat but gained in cotton.

### 3. Large speculators gained consistently on all their transactions.

Gray (1960) challenged the concept and concluded that bias in prices was not a characteristic of futures markets. He considered that in markets where it did exist it was attributable to the unique structural characteristics of a market rather than to futures trading *per se*. He studied a number of smaller futures markets, and proposed a “market-balance” approach. Although hedgers will pay a risk premium for hedging in a biased market, price fluctuations in an efficient (balanced) market, by definition, occur randomly as well informed participants over-adjust and under-adjust to new market information. He defined a biased market as one where the contract terms consistently favour one side of the market, buyers or sellers, so that future price levels are either overestimated (such as the potato futures market) or underestimated (such as the coffee futures market) (Gray, 1961).

Gray (1979) then examined the continuing bias induced by commercial positions in the corn and soybean markets. To test for profiteering in a biased market, he utilised a trading rule which bought futures on the date that short hedging reached its maximum, and held that position until hedging first became net long. When hedging reached maximum net long, he sold futures until they reverted again to net short. A speculator following this pattern would have lost an average of nearly four cents per bushel per trade on the corn market, and twenty-two cents per bushel per trade in soybeans. Gray concluded that when the market is balanced, as in these two cases, speculators are unable to profit from simply maintaining a perpetual net long position; from this he concluded that markets with relatively high levels of speculation are most effective for hedging because they are more balanced, and those with low levels of speculation are least effective.

The third form of speculation is spread trading. A spread trader absorbs the imbalances in the degree of futurity desired by buyers and sellers. For example, if a seller desired a nearby future and a buyer a more distant future, a spread trader might match these positions. Spread traders attempt to profit, not from predicting price levels *per se*, but from predicting changes in relative price levels while holding simultaneous opposite positions in futures.

A spread can exist within just one market, or between two or more markets. In the case of the intramarket spread, the trader could, for example, buy a September corn contract and sell a December corn contract. The trader will then wait for an expected gain on the December price by the September contract before September. Successful intramarket spreads usually arise in markets with seasonal commodities. Intermarket spreads involve the same concept, but utilises the principle in two or more markets for either the same or different commodities.

### **2.3.2 Price Discovery in the Commodity Futures Market**

The preceding section recognised that by providing a forecast, or price discovery, the futures market better enables firms to plan production and storage decisions efficiently. This enhances inter-temporal resource allocation. This section, however, said little about the price discovery process *per se*.

Speculators are central to the price discovery process for two reasons. First, market makers increase liquidity and therefore enhance the quantity of price information. Second, position and spread traders enhance the quality of the price information because gathering and acting on quality information is the only way they will profit.

#### **2.3.2.1 Speculation and Market Liquidity**

Speculation is important to the price discovery process because it increases the flow of information about future prices by increasing liquidity and the volume of trading. This is shown by that fact that as much as 90 - 95 % of futures trading is speculative in large markets and 40 - 60 % in small markets, and by fact that most speculators are considered to be market makers who directly provide liquidity.

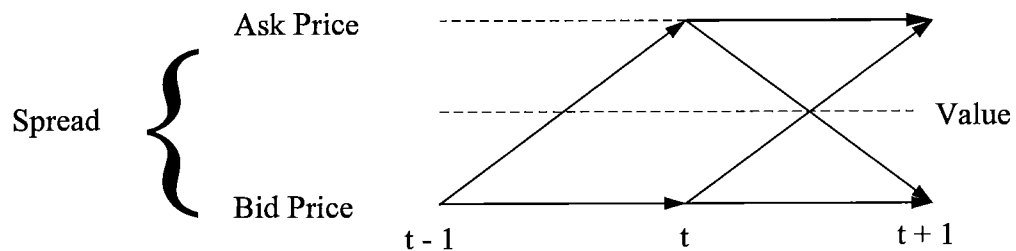
However, there is an apposing argument which is based on the fact that this increased volume of trading is not information based. In the most active market, where scalpers stand ready to buy or sell at a price no more than a tick below or above the last quoted price, the scalper hopes that no new information comes to the market while a position is open, so such trading is not information trading. Roll (1984) diagrammatised the sequence of possible prices for transactions in a liquid market such as this. Suppose that the last transaction is an outside order to sell which is taken by a market maker. In

an active market with numerous competitive scalpers, a market maker will be willing to accept that order at the bid price. If the next order were a sell order again, then it is likely that it would be accepted at the bid price also, but if it were a buy order it would be accepted at the ask price. This is illustrated in Figure 3.

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**FIGURE 3: IDEALISED SEQUENCES OF TRANSACTIONS PRICES IN A LIQUID MARKET**

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Source: Roll, R., "A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market", *The Journal of Finance*, Vol. 39, No. 4, 1984, p. 1128.

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However, because new information does arrive at the market, and prices change accordingly, this argument can be rebutted. Scalpers must compose their trading strategy carefully to be successful.

Although it is clear that scalpers add liquidity, past studies have proven that successful scalpers can earn consistent profits which may be argued to increase the costs borne by the hedger for transferring price risk. However, the important implication is that by adding liquidity to the market, even with increased costs to hedgers, the extra liquidity allows a constant array of prices to flow to the market more often. This means more price information is available to all participants.

Roll's (1984) study showed that in the absence of new information, all paths shown in Figure 3 are equally likely, and the correlation coefficient between successive price changes will be  $-\frac{1}{2}$ . Peck (1985) references Thompson (1984) who extended this model to apply to futures markets, and relaxed the assumption that no new information arrives at the market. The study indirectly revealed the effects of active market making by showing that the serial correlation coefficient between successive price changes can still be negative, and that the magnitude, although generally lower than in a market with no new information, increases as market activity increases. Therefore, in a futures market with greater liquidity — tacitly obtained from increased scalping activity —

prices fluctuate in a very narrow bid-ask spread around the equilibrium price which provides consistent information. In markets with much less liquidity — from less scalping — prices fluctuate more widely and irregularly around equilibrium values, resulting in inconsistent information.

#### ***2.3.2.2 Speculators and Market Information***

Speculators, who are position or spread traders, also play an important role in the provision of information. Where market makers enhance price information quantity, position and spread traders tend, on the other hand, to enhance the quality of that information.

Futures prices depend on current information about the future supply and demand (Telser, 1958, and 1967). More informed predictions are more accurate than less informed predictions. As with any market, the futures market provides monetary rewards for those who convey accurate, and hence economically useful, timely information, and monetary penalties for those whose information is inaccurate or untimely. Therefore over the longer time frame, assuming that unprofitable traders will exit the market due to constant losses, futures prices will reflect the most accurate and recent information possible.

However, in real markets, fragments of information are dispersed among many individuals, and it is costly and time consuming to acquire and communicate information. Therefore supply and demand functions are normally neither complete nor perfectly accurate, and if the introduction of a futures market attracts uninformed traders, it is conceivable that price predictions would become less accurate.

Clearly, producers and consumers will have closer alignment with the sources of accurate and timely information, but the nature of speculators results in the expending of resources to draw upon available information and to analyse this information to produce accurate forecasts of future prices. The fact that large speculators consistently make profits indicates that speculators do enhance the information content of futures prices. All participants benefit from this forecasting.

Cox, 1976, investigated the effect of organised futures trading on information in spot markets. The study involved six markets which had accompanying futures markets,



and for each spot market a model was developed to predict future spot prices based on past spot prices. This model was then applied to data for a period which had an active futures market. In all cases, empirical evidence showed that futures price behaviour conveyed a strong information effect as spot prices became less dependent on past information after the introduction of futures trading.

## **2.4 Conclusion**

Futures markets provide two essential economic roles. Firstly, entering the futures market provides *hedging* or insurance facilities for commodity producers and consumers by providing an offsetting gain in one market for a loss taken in another. Secondly, the existence of a futures market provides *price discovery* or the forecasting of future prices. Essentially, the futures market may be considered as a means to transfer risk from consumers and producers of commodities, who want to reduce their risk on forward prices, to those consumers, producers or speculators willing to bear that risk. The market therefore allows a party who fears a movement in price to establish a forward price for the exchange of the commodity with another party who fears an opposite movement in price.

Because futures markets provide simultaneous quotations of value for the commodity deliverable at successive future dates, they provide for better allocation of resources in society, since producers are able to make informed storage decisions. Ultimately this leads to more social welfare. The difference between two simultaneous quoted prices, for successive delivery dates, for a storable commodity reflects the cost of storage, and arbitrage will ensure that an equilibrium position between storage costs and futures prices is maintained.

Speculators enhance the efficiency of futures markets in achieving these economic roles by adding liquidity so that the frequently unbalanced demands of hedging traders can be absorbed. Market makers increase the speed at which transactions can be effected. This increases the quantity of price information that flows to the market. Position and spread traders enhance the quality of the price information because that is the only way that they will be able to successfully profit from their activities.

### **3. The Detrimental Effects of Futures Markets**

#### **3.1 Introduction**

Although futures markets undoubtedly provide benefits to participants, they have been criticised because of possible detrimental effects. Three principal areas have been researched:

- The level of price efficiency in the futures market.
- The effect of the introduction of futures trading on capital formation and allocation.
- The effect of the introduction of futures trading on price volatility in the underlying physical market.

The conclusion of research shows that there are no detrimental effects of futures markets of any substantial magnitude.

#### **3.2 The Level of Price Efficiency**

New information influencing supply and demand arrives at random intervals. Therefore, prices ought to fluctuate in an unpredictable or random fashion. If this situation exists, the market is said to be efficient. This question is commonly asked of many markets, because in an inefficient market it is possible for some parties to derive excessive profits and the market is said to be unfair.

Fama (1970) developed early efficient market theory when he presented his “Fair Gain” model. It assumes that the price of a security fully reflects all available information at a point in time. He developed three categories of efficiency depending on the information set involved:

- Weak-form efficiency asserts that prices reflect all historical price information.
- Semistrong-form efficiency asserts that prices adjust rapidly to the release of all new public information and therefore reflect all public information.

- Strong-form efficiency asserts that prices fully reflect all information including that which is publicly and privately available.

As many markets are assumed to be at least weak-form efficient, most studies assess the other two categories. Tests of futures markets tend to show that they are semistrong-form efficient. Conklin (1983) concluded that grain futures prices were semi-strong efficient with respect to the weekly release of export sales information. Leuthold and Hartmann (1979) however, formed an opposite conclusion in the hog futures market. They developed a simple model using supply and demand data which provided substantial profits when the model's predictions were used to trade futures.

In conclusion, evidence exists for and against futures market efficiency. The level of efficiency may be relevant to specific markets, and dependent on a number of variables.

### **3.3 The Effect on Capital Formation and Allocation**

The most recent debate concerning futures markets questions the impact these markets have on capital formation and allocation. This is principally because of the introduction of financial futures, but also because of the recent rapid growth in trading volume and open interest in all futures markets. In particular, concern has been expressed that funds are being diverted into futures markets which would otherwise be allocated towards the acquisition of equity and debt, or real capital assets, and therefore futures markets depress investment in these areas. The most common notion on which this concern seems to be based is that there are a fixed number of speculative investors employing a fixed amount of financial capital, and that when such investors take positions in futures markets, they do so by reducing their holdings in other financial assets.

#### **3.3.1 Capital Formation**

The U.S. Committee on Agriculture (1985) study addressed these issues and concluded that futures markets do not absorb the real savings of society, and therefore they do not alter the formation of capital. First, the resources absorbed by such facilities as buildings, exchange staff, computer equipment, and brokerage commission — which equate to transaction costs — are all relatively immaterial from the view point of

society's entire wealth. Further, although these costs are quite real, the individuals who directly incur these costs must perceive that the hedging benefits far outweigh the costs, otherwise they would not wish to use the futures market.

Secondly, by considering the process by which funds are used to form and maintain positions in a futures market, it can be concluded that the formation of capital will be unaffected. In order to engage in a transaction, a margin is required from both the long and short traders. Other than transaction costs, the margin is the only other cost that is required to form a position in the market. In some cases a market participant can pledge a risk free interest bearing asset, which is acceptable to the exchange, such as a Treasury Bill. In other situations, the participant will deposit cash which is usually invested in the same type of risk free interest bearing asset described above. In both scenarios, the holdings of financial assets in the economy remain unchanged, and the availability of funds to financial markets is not reduced.

Thirdly, the same argument applies to the effect on capital formation of maintaining a position in the market. The marking-to-market system requires market participants to redistribute funds according to profits or losses made on a daily basis. As with deposit margins, this redistributes funds only between investors. It does not alter the total holding of financial assets in the economy. Nor will it change the availability of funds to financial markets.

### **3.3.2 Capital Allocation**

Although these three points appear to be relatively well accepted (U.S. Committee on Agriculture, 1985, and a number of academics, for example, Jaffee, 1984, and Stein, 1984), uncertainties exist as to the net effects of futures markets on decisions to allocate the stock of real capital, and/or the rate at which capital is accumulated over time. A number of hypotheses exist which assert that futures markets promote the allocation of capital toward relatively risky assets, while other hypotheses assert the opposite conclusion. Because of limited data, no acceptable anecdotal or statistical evidence is available to form a conclusion about these hypotheses. However, if a problem was proven to exist, the effects are unlikely to be large.

The first hypothesis advances that because futures markets make it possible to reduce the level of risk exposure, they may encourage allocation of real capital to riskier

activities than would otherwise occur, so the net position of risk remains constant. For example, suppose that a firm considers the possibility of producing a new product called the “Super Supportive Car Seat for Disabled Persons”, a product that will revolutionise seating comfort for disabled people while travelling. In addition to the risk that the product will not sell after a large capital investment is made in necessary new machinery, the firm faces the risk that the cost of timber (which is the main component) will increase. With the introduction of a timber futures market, the balance may change and the project may become viable because the proportion of the risk arising from fluctuating input costs may be eliminated therefore reducing the total risk of the project.<sup>21</sup>

The second hypothesis advances that, while the opportunities to hedge risk would seem to encourage investment in relatively risky ventures by some, consideration must also be given to the effects on the asset preferences of those who speculate in the futures markets. Given their exposure to risks transferred from hedgers, speculators may be inclined to reduce their proportion of relatively risky assets in their portfolio, including shares in high risk venture capital companies such as the one considered in the example above, and simultaneously increase their holdings of risk free assets.

In conclusion, the formation of capital is not affected with the introduction of futures markets. The effect futures markets have on the allocation of capital is less conclusive. There are hypothesised arguments which assert apposing views. While the increase in ability to transfer risk may encourage hedgers to invest in more relatively risky assets and projects, the assumption of these risks by speculators may tend to reduce their willingness to take on such investments. No conclusive evidence exists regarding these issues, but the net magnitude of the effect is considered to be small.

### **3.4 The Effect on Price Volatility in the Primary Market**

The price stabilising effects on primary markets which occur with the introduction of a futures market, and in particular with speculators present, has been subject to

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21 A similar example could be conceived of financial futures markets. For example, a prospective investor who is confident that a venture capital firm will out perform the market, but is uncertain that the market will provide positive returns at all, may wish to go long on the venture capital firm's share to take that gain, and go short on a futures contract on the NZSE-40 to reduce market risk.

considerable theoretical debate and empirical testing. Several hypotheses have been advanced which assert opposing results. However, empirical evidence has concluded that cash market prices are subject to no more, and in some cases less, fluctuation after the introduction of futures markets.

### **3.4.1 Theoretical Arguments**

Speculators profit if they buy when prices are low and sell when they are high. There is a basis then for considering that their trading should tend to stabilise, rather than destabilise prices (Friedman, 1953). To see this point more clearly, consider the following hypothetical situation in an agricultural market. Suppose that incoming information begins to suggest that a crop failure in an upcoming period is likely. Speculators responding to this news would tend to store the current crop for resale at a future date. Alternatively, speculators might go long in a futures contract, thereby raising the price in the futures market relative to its equilibrium relationship with the cash market price. This, in turn, would elicit transactions by arbitrageurs who would buy a proportion of the current crop to hold for delivery at a later date and simultaneously short the futures. The net effect of these trades would be to make cash and futures prices better reflect the expected change in economic conditions.

It is important to note that this stabilisation is relative. Prices will not be totally stabilised, but will be relatively more stable than they would be in the absence of a futures market and speculators in that market.

For speculation to work in a stabilising manner, however, speculators' expectations must be accurate on average. Critics of futures markets often contend that speculators are generally uninformed traders, relative to hedgers who have superior knowledge because they handle the physical commodity, and therefore speculators tend to destabilise prices (Cox, 1976).

Kaldor (1939) added to the opposing view by arguing that speculation would be unprofitable in the long run because a small group of knowledgeable speculators could earn profits at the expense of a constantly changing and larger group of unsophisticated speculators. Therefore speculation could destabilise prices because the sophisticated speculators would be willing to buy at prices above a competitive equilibrium price, if they expected to sell at a higher price to unsophisticated speculators.

Baumol (1957) and Telser (1959) took a different theoretical approach to the problem, choosing to address the timing of price movements rather than simply the level of prices. Baumol concluded that speculators buy and sell after a trend is established, and this destabilises the primary market, but Telser found the opposite conclusion — that speculators concentrate their transactions before the turning point which stabilises the market. However, Baumol (1959, p. 263) stated in reply to Telser: “. . . the effects of profitable speculation on stability is in part an empirical question and . . . attempts to settle it by *a priori* arguments must somewhere resort to fallacy.” Therefore while there are logical theoretical arguments which both support and refute the proposition that speculation will destabilise prices, the issue is unresolved and requires empirical investigation.

### 3.4.2 Empirical Evidence

Since early theoretical arguments, a considerable number of empirical analyses on several agriculture markets have become available.<sup>22</sup> The basic approach of these studies has been to compare the relative degree of variation of prices in the primary market in two periods, before and after the introduction of futures trading. In summary, the findings of empirical studies generally suggest that cash market prices were subject to no more, and in some cases less, fluctuation after the introduction of futures markets.

Working (1960) and Gray (1963) conducted studies of the price volatility in the onion market which had an inactive futures market from 1942-1949, and an active futures market from 1949-1958. After 1958 the onion futures market discontinued because of government legislation. The two studies show, in conclusion, that price variability in the primary market was less during the period of active futures trading, and that it returned to its earlier levels when the futures market was discontinued.

The studies of Working and Gray involved seasonal price changes. Working found that a significant price decline in within-month price volatility was also associated with the period of active futures trading in onions. Powers (1970) found significant declines in monthly volatility in both the live beef and pork belly market after the

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22 It is interesting to note that empirical analysis of the effects of commodity futures markets on cash market stability can be traced at least to the late 19th century, for example, Emery (1896).

introduction of futures trading. The conclusion applies to both seasonal and non-seasonal commodities, and also to financial futures markets.<sup>23</sup>

In addition to this empirical work, there has been another body of statistical analysis that bears on the issue under review. This endeavours to identify the statistical properties of price fluctuations in underlying markets. The major finding of this body of work, which has been largely carried out on financial markets, has found that primary markets largely display a pattern of behaviour referred to as a random walk. This means that prices, adjusted for long-term trend effects, have no systematic, and thus predictable, movement based on prior price movements.<sup>24</sup> The important implication of this finding is that it is inconsistent with the hypothesis, considered above, that primary market prices are constantly prone to speculative bubbles, the type of excessive fluctuation that has traditionally been a major concern.

In conclusion, theoretical arguments have not been able to form any conclusion as to whether futures markets have an effect on price volatility in the underlying cash market. However, conclusive empirical evidence has shown that cash market prices are subject to no more, and in some cases less, fluctuation after the introduction of futures markets.<sup>25</sup>

#### **4. Conclusion**

Futures markets trade contracts with standardized specifications for the purchase or sale of commodities, or financial instruments, at predetermined delivery dates in the future, at prices agreed upon when the contract is entered. The specifications detail the quality of the underlying asset, unit size, price quotations, minimum fluctuations, contract value, mandatory settlement value, final trading day, settlement method, mandatory settlement price, tick size, initial margin, and settlement months. The exchange determines the contract specifications and administers the operations of the clearing house which adds integrity to the market. The settlement method is particularly

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23 For example, Bortz (1984) and Simpson and Ireland (1982).

24 For example, U.S. Committee on Agriculture (1985).

25 Simpson (1982), Bortz (1984) and Edwards (1988) provide the same analysis in financial futures markets.



important because it determines the relationship between the futures and cash market prices.

Futures markets provide two essential economic roles. Firstly, entering the futures market provides *hedging* or insurance facilities for commodity producers and consumers by providing an offsetting gain in one market for a loss taken in another. Secondly, the existence of a futures market provides *price discovery* or the forecasting of future prices. Essentially, the futures market may be considered as a means to transfer risk from consumers and producers of commodities who want to reduce their risk on forward prices, to those consumers, producers or speculators willing to bear that risk. The market therefore allows a party who fears a movement in price to establish a forward price for the exchange of the commodity with another party who fears an opposite movement in price. The exchange guarantees the performance of these contracts and so there is no possibility of either party incurring a loss through contract default.

Because futures markets provide simultaneous quotations of value for the commodity deliverable at successive future dates, futures markets provide for better allocation of resources in society since producers are able to make a very informed storage decision. Ultimately this leads to more social welfare. The difference between two simultaneous quoted prices for successive delivery dates for a storable commodity reflects the cost of storage, and arbitrage will ensure that an equilibrium position between storage costs and futures prices is maintained.

Speculators enhance the efficiency of futures markets in achieving these economic roles by adding liquidity so that the frequently unbalanced demands of hedging traders can be absorbed. Market makers increase the speed at which transactions can be effected. This increases the quantity of price information that flows to the market. Position and spread traders enhance the quality of the price information because that is the only way that they will be able to profit successfully from their activities.

Although futures markets undoubtedly provide benefits to participants, they have been criticised because of possible detrimental effects. Firstly, evidence exists for and against futures market efficiency, and the level of efficiency is essentially relevant to specific markets, and dependent on a number of variables. Secondly, futures markets do not absorb society's investment funds, and therefore the formation of capital is not affected with the introduction of futures markets. The effect futures markets has on the

allocation of capital is less conclusive, but the net magnitude of any effect is likely to be small. Thirdly, theoretical arguments concerning the price stabilising effects on primary markets which occur with the introduction of a futures market have been inconclusive. However, conclusive empirical evidence has shown that cash market prices are subject to no more, and in some cases less, fluctuation after the introduction of futures markets. Therefore, in summary, no major detrimental effects occur with the introduction of futures markets.

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**PART III:**  
**DETERMINING A SUCCESSFUL FUTURES**  
**CONTRACT**

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## **1. Introduction**

As considered in Part II, the economic roles of futures markets are, *intra alia*, shifting risk and price discovery. Despite universal consensus on this issue, there is no economic theory concerning the successful development of futures contracts. In fact, a contemporary definitive list of prerequisites, or feasibility conditions, for a successful futures contract is totally nonexistent in the literature.

Contract feasibility studies are customarily produced as internal documents of the exchange and subsequently are rarely published. This may account for the relative dearth of literature on the topic.

In surveying discussion on prerequisites for successful futures markets, for nearly each and every requirement that has been detailed, there now exists a contract which provides an exception. For these reasons, research in this area is necessarily exploratory.

## **2. The Relative Success and Failure of Futures Contract Innovation**

A successful contract can be defined as one that attracts a lot of trading interest. Just how much interest is necessary for a contract to be deemed successful requires a subjective answer. Ring (1992) suggests with reference to trading in the United States that “actively traded” futures must trade at least 750,000 contracts annually, which equates to 3,750 per day, and the total dollar value of these contracts must equal at least 33 % of the value of recent average world production in the underlying commodity. As Ring’s threshold test is based on large successful American markets; the New Zealand daily average volume of contracts traded may be more relevant for the purposes of this study. The average daily volume on the NZFOE during 1993 was 2,666, which, over four contracts, equates to 666 trades, per contract, per day.

Futures trading this century has seen the introduction of many new contracts. The NZFOE, since inception in 1985, has launched 13 new contracts. However, 7 have been

delisted and a further 2, although still listed, have almost negligible trading.<sup>26</sup> The same pattern is evident else where in the world. 128 new contracts have been listed in the United States this century, but only 45 currently trade actively, and only 8 of these contracts have survived from the 1930s (CBT, Verbal Statement, 1994).

In examining specific instances of innovation an anomaly appears. Some pairs of commodities appear to have similar characteristics, yet a futures contract on one fails where the other succeeds. The commodities in the left column of Table 2 each enjoy a successful futures market, but the commodities in the right column have each had futures contracts which never attracted much volume, and subsequently failed. However, the commodities in the columns appear to be in pairs which share common characteristics.

**TABLE 2: COMMODITY PAIRS WITH SUCCESSFUL AND FAILED CONTRACTS**

<i>Successful</i>	<i>Failed</i>
Pork Bellies	Skinned Ham
Copper and Silver	Tin
Cotton	Tobacco
Soybeans	Peanuts
Corn and Wheat	Barley
Certificates of Deposits	Commercial Paper

In the example of pork bellies and skinned ham, pork belly trading started in 1961 and ham in 1964. There are two hams and two bellies in each hog, and both the value of each commodity and volatility of price are approximately equal. In 1967, pork bellies traded over a million contracts whereas only 425 contracts were traded in ham (CBT, Verbal Statement, 1994).

Further, in “perfect competition” models, where the same physical commodities are sold and consumed on different dates, it is assumed that there exists a “universal regime of futures markets . . . extended to all times and all commodities” (Arrow, 1981, p. 4; and Veljanovski, 1985, p. 14). This is clearly a long way from existence in reality.

26 Recently, two new contracts have been introduced, but it is too early to consider their acceptance as no trading data is yet available.

The poor success rate of innovation, the anomaly between pairs of seemingly similar commodities, and the implications of textbook perfect competition raise the question as to why some contracts succeed and others fail, and why are there not more futures markets. The objective of Part III is to investigate these issues.

Currently no generally accepted theory of futures contract innovation exists. The literature simply proposes principles of “Instrumental Reasoning” which are conjectured to maximise, or at least contribute to, the likely success of a new contract (Mattessich, 1978). Given the past strike rate these principles are clearly unsatisfactory. Anderson (1984, p. 26-27) recognises the obvious importance of determinates of successful futures trading, but notes that “no comprehensive analysis of the issue has been attempted”. Hieronymus (1977, p. 30) observed that “the question of why some commodities are traded and others are not and why the volume varies as it does” has not been answered “else there would not be such a record of failures”. An earlier authority, Gray (1966, p. 115) stated that, “I don’t really know why futures trading succeeds or fails”. Given the obvious difficulties past researchers have had with this topic, a general theory for successful innovation is not derived. This would appear to be beyond the scope of this thesis. Part III focuses on the exploration of prerequisites for successful innovation.<sup>27</sup>

### **3. The Approach of Literature which Considers Futures Contract Innovation**

The general theory of Financial Innovation, outlined by Silber (1977, p. 64) considers innovation of financial instruments “occurs in an effort to remove or lessen the financial constraints imposed on firms”. This is true of the futures market where the economic roles of futures, as described in Part II, provide a means of transferring price risk. This function clearly reduces the financial constraints imposed on firms by price risk.<sup>28</sup> However, although this may be the basic reason why the market exists, it provides no insight into which contracts will succeed and which will fail.

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27 The development of a complete theory on developing successful contracts would be a topic worthy of research.

28 For example, by hedging against price risk, a firm may be able to borrow more finance because a bank is more prepared to lend funds to a company which has certain cash flows from sales and purchasers as against one which has uncertain cash flows because of fluctuating prices.

The approach of literature which considers the feasibility of new futures contracts can be segregated into two categories:

- *Commodity Characteristics* — this approach defines feasible commodities for futures trading based on an extensive list of required commodity attributes. However, although this approach appeals intuitively, only a few characteristics have remained important over time.
- *Contract Characteristics* — many essential commodity attributes were rejected as new contracts provided examples of exceptions to traditional rules. Researchers recognised that imperfect specifications often failed to attract hedging interest, and that changes to contract specifications can result in a failing contract becoming successful. Subsequently, analysis began to focus on contract design.

#### **4. Commodity Characteristics**

Identifying commodities suitable for futures trading probably began at the time the first futurity markets evolved. Innovative exchanges were able to identify certain characteristics that commodities with futures markets shared in common. Table 3 synthesises the work of a number of early writers who detail these attributes, including, Baer and Woodruff (1929) and Baer and Saxon (1949). These factors have also been detailed in Goss (1972), Goss and Yaney (1976), and Calton (1984).

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**TABLE 3: CHARACTERISTICS OF COMMODITIES SUITABLE FOR FUTURES TRADING**

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1. The commodity must be subject to frequent price fluctuations with wide amplitude that have significant impact on profitability, and the fluctuations must be unpredictable.
  2. Supply and demand must be large, and the number of participants in the market must be large.
  3. Supply must flow naturally to a competitive and unregulated market with low delivery costs.
  4. The commodity must be durable and storable.
  5. The commodity must be homogeneous.
  6. There must be a break down in forward contracting.
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#### **4.1 Price Variability**

As stated in Part I, if the input or selling price of a commodity changes in a negative manner the effect on business profits, and investment worth, can be disastrous. The risk of this occurring is commonly termed “price risk”. Price risk will occur, firstly, when the commodity price is volatile, and secondly, when there is a mismatch in the time at which an individual’s buying and selling prices are set.

The existence of price risk caused the initial futurity trading in Imperial Japan where these two conditions were met, and this factor has remained one of foremost importance throughout the evolution of futures markets. The existence of price risk is critical if a futures contract is to provide hedging benefits, and if there is no hedging benefit the contract will fail because there will be no demand. A hedger will not wish to use a futures market when there is no possibility of incurring a loss because prices remain stable over time. Similarly, the attraction of the futures market to the speculator requires price variability. If there is no movement in price, there is no possibility of financial gain. However, if there is uncertainty about price then buyers and sellers with fixed quantity commitments can use a futures market to hedge their risks, and people with different beliefs about price can use a futures market to speculate on their beliefs.

Working (1954) was the first to recognise the critical relationship between the amount of hedging use and the futures market. Gray (1960, 1961, and 1966) also recognised the relationship and formed the conclusion that, “the first prerequisite to the success of the futures market is hedging use” (Gray, 1966, p. 122). Telser (1981) formalised the prerequisite into a cost/benefit theory to show that futures trading volume may increase or decrease depending on changes in levels of price volatility. Although



no empirical evidence was provided, he conjectured that a positive association existed between price variability and volume.<sup>29</sup> As variability increases so does volume, and this reflects the fact that “[t]he benefit of having organised futures trading increases as . . . price variability increases”.<sup>30</sup> Telser also asserted that price variability is a cause of volume and is not the effect of it.

Further, Telser argues that if the price variability of a commodity falls and subsequently the demand for futures trading falls (because less hedging is required), the lower volume of contracts traded reduces liquidity and drives up the incremental costs of trading. These incremental costs amount to commissions and margins which are normally charged on a per unit basis. Also, the spread between trader’s bid and ask price tends to increase as liquidity decreases (Working, 1967). As per unit costs increase, the demand for trading also has a further detrimental effect on volume. Telser argues that the process equilibrium depends on the shape of the marginal cost curve, and conceivably the equilibrium could be at zero trading volume. An increase in price volatility would set about the opposite motion (Acheson and McManus, 1979).

Cornell (1981) assessed the statistical strength of the relationship between futures trading volume and price variability. He found that a significant, positive, contemporaneous correlation existed between the changes in average daily volume and changes in the standard deviation of daily log price relatives for 14 of the 18 commodities tested.

#### **4.1.1 Price Variability Normally Initiates a Futures Market Feasibility Study**

Increasing levels of risk arising from price volatility in the underlying market normally initiates a futures market feasibility study. Such risk does not simply develop overnight, but evolves over time as factors affecting price become uncontrollable by producers and consumers and instead become controlled by external parties (for example, foreign governments or international markets). Further, price influencing factors may also become inextricable (for example, suppose that prices are linked to

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29 However, this claim has been substantiated by Cornell (1981) and Bhattacharya (1986) *et al.*

30 Telser provides the example of the foreign exchange contracts. In 1971, the fixed-exchange regime was abandoned. Prior to that there was little trade in forward exchange as there was simply no need. However, as soon as the price support regimes were abandoned the futures markets sprung up.

foreign exchange rates, government economic policy and production costs, but that the relationship of each of these factors to price is indeterminate). As these scenarios develop, market participants may increasingly become interested in the prospect of passing on price risk so as to be sure of their investment's returns.

#### **4.2 Large Cash Market**

There appear to be five reasons why the underlying market is required to be large in terms of both volume and number of participants. This prerequisite has also remained important over time. First, the larger the number of participants in the underlying market and the larger the volumes traded, the larger the likely interest in futures trading, and hence the greater likelihood of success of a futures market.

Second, larger markets provide for continuous and orderly trading as clearing of supply and demand forces continually met at equilibrium more often. As a consequence, liquidity is much greater in larger markets. This is true of all markets, but it is particularly important for futures where high levels of liquidity are necessary so that cash-futures arbitrage will occur and the cash and futures prices will converge.

As described above, in markets with low liquidity the cost of trading will be higher (Acheson and McManus, 1979). This explains why futures trading tends to be concentrated in a single contract, in a single market, for each commodity, and why the proliferation of contracts tends to have a higher probability of failure (Goss and Yamey, 1976). It is also a possible explanation as to why a proven successful exchange is at an advantage in contract innovation (Working, 1970).<sup>31</sup>

Third, manipulation of the market is more difficult if supply and demand are large in proportion to individual interests. However, if supply is limited, participants with large financial resources may be able to control the market to their advantage. Market manipulation is considered in more depth later.

It is important that the market size of the deliverable commodity is assessed when considering these three issues. The original New Zealand Wool Futures contract, which

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31 By the same reason, it explains why primary producing countries, unless they have well developed commercial and financial sectors, are at a disadvantage in the local establishment of futures markets in the primary products they produce.

is based on an a deliverable commodity of 35 micron wool, partly failed for these reasons. The number of farmers who produced this wool was limited (not to mention the number of farmers who wanted to trade the contract), and the number of buyers was very limited (possibly as few as 20). (NZFOE, verbal comment, 1994).

Fourth, the structure of the market is important, in addition to size, and can have a significant effect on hedging demand. Assuming in a given market there exists some price risk and a futures contract which can provide some hedging benefit, the contract may still fail if there is no demand because the structure of the market removes (or reduces) the market participants' exposure to price risk (Goss, 1972). For example, there may be no demand because:

- Market participants are earning super normal profits and price fluctuations in purchases or sales do not affect their overall profitability significantly.
- The industry is structured in such a way that the large majority of participants are fully vertically integrated and price risk has no consequences for them. Although vertical integration may occur independently of market size, it tends to occur more often in larger markets.<sup>32</sup>
- The industry uses a well developed forward market (for example, the forward foreign exchange market), or long term supply arrangements, or a futures contract in another country which is able to provide the necessary hedging benefits.

Fifth, the monetary value of the market is as important as the volume. *Ceilis parilis*, the greater the monetary value of product exposed to price risk, the greater the monetary benefit from hedging. Naturally, if more is at stake, risk-adverse market participants will want to hedge more. More speculation will also result because those

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32 In the process of timber production, a sawmill would buy logs from a forest owner and there would be two firms who could desire the hedging benefits of a futures market. However, if the sawmill and the forest owner were owned by the same entity, the vertical integration of the two firms produces a situation where their exposures to price risk are equal and opposite and therefore cancel out.

risk-takers will have a greater incentive to invest in prediction when monetary values are large (Carlton, 1984).

### **4.3 Supply Flowing to Market**

The third prerequisite which has remained important over time is that the underlying commodity must flow naturally to a competitive and unregulated market with low delivery costs.

#### **4.3.1 Competitively Determined Price and an Absence of Regulation**

The price of the underlying commodity must be competitively determined — that is, the price should be determined according to supply and demand forces. The market should be free from control by a government, cartel or monopolist.

Government price fixing controls or buying agreements effectively remove the need for hedging as they remove price risk in both instances, and usually substantially influence the price in the second instance. Government influence has resulted in a number of U.S. futures markets collapsing in the past. Gray (1966 and 1970), Kohls (1967), and Telser (1981) list coffee, cotton, butter, rice, tobacco, and peanuts all as commodities which have been influenced. The largest influence is undoubtedly the outright removal of the U.S. onion futures market in 1958. Government influence was also substantial during World War II where regulations rendered several futures markets useless. In 1946 there were only 17 futures contracts, but by 1947, the number had more than doubled to 36.

The Hunt brothers in 1979-80 provide an example of how a large market participant can substantially influence the market. They made an unsuccessful attempt to control the price of silver in the cash market which would have enabled them to take advantage of futures positions. When this became evident, the volume of trading at the Commodity Exchange, Inc. (COMEX) and the CBT declined 74 % and 83 % respectively.

#### **4.3.2 Low Delivery Costs**

As stated in Part II, the delivery process is important if the cash and futures are to converge at settlement. However, perfect arbitrage completely removing any deviation

in the futures-cash price will occur only if transaction costs are nil. Garbade and Silber (1983, p. 454) noticed that:

the incentive to undertake such transactions declines as a function of delivery costs. If these costs are high, even relatively large cash/futures price differences may not generate arbitrage orders, so that price convergence will not occur.

If convergence does not take place then hedging benefits will be substantially reduced.

A number of commodities do have high delivery costs, and unfortunately logs and timber are examples because of the weight of these commodities and because they require costly grading. Other examples include wheat and corn, and particularly potatoes. High delivery costs are normally a function of:

- Transportation costs where the delivery point is at a distant and inconvenient location, and where the commodities concerned are large.
- The cost of keeping supplies in deliverable condition.
- The cost of grading supplies for delivery.

If high delivery costs do exist, then for a futures contract to be successful it must represent a substitute for the normal marketing method and the cost of delivering the commodity under the futures contract must be no more than the cost which would be incurred by traditional marketing so that participation in either market incurs the same cost.

#### **4.4 Commodity Durable and Storable**

Traditional futures theory considered that the arbitrage process requires that the owner of the underlying commodity is able to make a choice between selling in the present, or holding the commodity and selling it in the future. In order to hold the commodity for latter sale the commodity must not perish or deteriorate in the interim time period. All early futures markets supported this proposition by trading continuously storable products like grains, coffee, cocoa, tin and cotton.

#### **4.5 Homogenous Product**

The commodity must be totally homogenous, according to traditional futures theory, so that it can be specified in the standardised terms of futures contracts and

traded “sight unseen”. Buyers and sellers need to know with certainty what they are required to deliver or will receive, and this is not possible for a non-homogenous product. Hoffman (1932) observed that the key to easy and accurate identification of a homogeneous product was a system based on a measurable physical quality, a scientific rather than personal evaluation.

Therefore, those commodities in which official quantifiable standards of this sort cannot be constructed — so that a sufficiently homogenous grade can be distinguished — are deemed not suitable for futures trading. Baer and Saxon (1949, p. 119) provide an example involving tea where grading requires “not only expert opinion, but individual taste as well”.

#### **4.6 Preceding Existence of Forward Contracting**

One fundamental justification for futures markets is their ability to reduce price risk faced by hedgers. However, as noted in Part II, there are viable alternatives to the futures market. Price risk can be reduced effectively without standardising deferred delivery contracts to the degree of futures contracts. Forward contracting is the most common alternative, and in some instances, for example the foreign exchange market, it has developed to very sophisticated levels.

However, the forward market is not a perfect substitute:

- In forward contracting, participants bear the risk of the other party defaulting on the contract. In the futures market the clearing house guarantees the performance of the contract, and because of the operation of the margin system losses very rarely occur.
- Because forward contracting is a personal agreement, altering the terms of the agreement or terminating the obligation prior to the settlement date may be difficult. In the futures market traders are able to simply offset their position because the market is very liquid.

Although, there are disadvantages, the forward market allows contract conditions to be tailored to the specific needs of the parties concerned. The benefits of forward contracts may outweigh the drawbacks. Alternatively, the benefits of a futures market outweigh the benefits of an existing forward market. Under traditional futures theory, it

was only in this second case that a futures market was considered to be viable. Some traditional researchers even asserted that forward contracting must have previously existed and failed before a futures market would be feasible (Baer and Woodruff, 1929).

#### **4.7 Exceptions to the Rules of Traditional Prerequisites**

##### **4.7.1 Introduction**

Between 1960 and 1970 futures trading volume roughly tripled in the United States. Between 1970 and 1980, volume rose by a factor of approximately seven. Between 1980 and 1983, volume rose by a factor of approximately ten (Carlton, 1984). But not only was there exponential growth in volume of futures trading during these years, there was also an exceptional degree of product innovation. Some innovation rendered traditional prerequisites obsolete.<sup>33</sup>

The most significant innovation was that the futures industry outgrew its historical agricultural boundaries and financial futures were born. Financial futures comprise three classes: currencies, interest rates, and stock indices. Each developed in response to economic events and as a result of futures industry innovation. The demise of the Bretton Woods system of currency stabilisation in the 1970s, and the elimination of the gold standard, led to the introduction of futures contracts on foreign currencies. Unprecedented interest rate volatility in government and private debt securities led to the introduction of interest rate futures contracts. The high levels of volatility commanded a method to hedge against risk, and to speculate on the movements. Stock index futures contracts were an innovative way to deal with volatility in the equity markets.<sup>34</sup>

The product innovation which facilitated financial futures trading changed the necessary prerequisites for successful futures markets. Many of these new prerequisites have now also been applied to commodity markets, but were not conceived until the advent of financial futures. There have also been a number of other advances.

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33 The volume of trading is still increasing. In 1993, the total volume of futures trading was 751.7 m contracts which represents an increase of 26.5 % for the year (CME, 1994).

34 The factors that have led to the globalisation of capital markets in general, namely the dismantling of controls on international movements of capital, the world wide deregulation of financial markets and the rapid growth of information technology, have all been important factors also.

#### **4.7.2 Price Variability, Large Cash Market, and Competitively Determined Prices**

These prerequisites have all remained important throughout the evolution of the futures market from the forward market. It is innovation in other areas which has enabled futures to extend to a broader range of markets. In particular, adjustments have been made to the factors of storability and homogeneous products, delivery mechanisms, and the preceding existence of forward contracting.

#### **4.7.3 Storability of Product**

First, since the 1950s there has been a number of technological advances which has increased the time frame for which many commodities may be stored. In particular the advent of refrigeration technology allowed frozen storage without loss of quality and enabled many commodities that were previously considered non-storable to become suitable for futures trading. This allowed contracts to be developed in refrigerated eggs, butter, broiler chickens, frozen turkey, shrimp, hams, pork bellies, and frozen orange juice.

Second, when it was conceived that the futures market not only aided the inter-temporal allocation of resources, but also provided a price discovery role, it was recognised that it did not matter that there were no current stocks in storage. What is relevant is that inventory becomes available, and that the futures price provides the best possible estimate of the future cash price based on currently available information on future supply and demand.

The ability to generate futures contracts without continuous supplies arriving at the cash market, and continual inventories, allowed futures markets to develop for seasonally produced discontinuous inventories. Examples of futures markets which developed from this type of innovation are: potatoes, fresh eggs, and live cattle.

This point has been well proven in recent years. Houthakker (1959, p. 158) however, has stated in the past that, “the mainspring of futures trading . . . is the need to finance inventories in the face of fluctuating prices. A prerequisite for sustained trading, therefore, is [still] the existence of considerable inventories.”



#### 4.7.4 Delivery Mechanisms

In addition to the rejection of the storability criteria, the possibility of trading live cattle was also aided by the contractual innovation of changing the delivery instrument. Previously the only accepted method was the warehouse receipt, where the commodity actually had to be delivered to a stipulated location. The live cattle contract, however, makes use of a “call on production” which means that the commodity does not need to be delivered, but rather just has to be available. A call on production therefore functions essentially in the same way as a “shipping certificate” which is simply a promissory note that a processor or shipper will ship a certain commodity within a designated period of time.

Further delivery innovation was made with the advent of “cash settlement”, which enabled the development of new kinds of markets. This first developed with the financial futures contract on the Value Line Index which was listed on the Kansas City Board of Trade in February 1982. Instead of delivering the basket of 1,700 stocks, which would be close to impossible, the contract, at settlement, was closed out with a cash transfer.

Garbade and Silber (1983, p. 452) define the difference between the settlement provisions:

A conventional delivery contract requires traders to make or take delivery at maturity to liquidate any remaining open positions whereas a cash settlement contract establishes an obligation for shorts to deliver cash to longs [via the clearing house] in an amount equal to a “settlement index” that reflects the cash market value of the underlying or [index formed] group of commodities.

They asserted that cash settlement improves the ability of futures markets to increase social welfare. First, there are two arguments for and against this proposition based on “hedging effectiveness”:

- A cash settled futures contract, by definition, will converge on the cash market price, and therefore the hedging and risk transfer functions of futures contracts are enhanced.
- Most conventional delivery contracts allow for the delivery of multiple grades, but a cash settled contract is settled on the specified average of the grades as

specified by the index. The important implication is that, while the former contract is priced off the cheapest deliverable grade, the latter is priced off the average grade. Because the average grade has fewer price changes than the cheapest grade, the cash settlement contract will subsequently incur less basis risk and will therefore provide better hedging effectiveness.

- However, although the assumption that the price changes of the average grade are lower than price changes of the cheapest grade is generally held to be correct, this may not always be true. Lien (1989a) concluded that hedging effectiveness is determined by the covariance between the futures and cash prices in addition to the variance of the futures price.
- Additionally, the hedging demand of cash settled contracts may be reduced because of potential participants' inability to comprehend the pricing methods applied to this type of contract. The pricing of ordinary futures is difficult for most newcomers to the market, but index based futures are even more difficult. The New Zealand Wool Futures contract, which was relisted in 1991, is based on a Wool Board index, but it has failed partly for this reason. Many wool farmers were unaware of the hedging benefits of futures markets *per se* and were frightened of the method by which the cash settled contract operated because they did not understand it. As such, farmers were unwilling to attempt to learn "the hard way", and so refused to trade (NZFOE, verbal comment, 1994). Had the contract called for actual delivery, rather than been index based, they may have had a greater understanding of the concept and it might have had a greater chance of success.<sup>35</sup>

Second, the cause of expiration day volatility is well known. It occurs when market participants (such as stock index arbitrageurs), who hold cash positions related to a futures position, close out their futures positions at the termination of trading. When a large number of such trades occur at this time, and if they are predominantly on one side of the market, a substantial order imbalance happens in the cash market. If the specialists in the underlying market cannot provide sufficient liquidity, these order

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35 The NZFOE possibly did not want to use a deliverable contract because it had failed previously. However, if the contract had been deliverable, and based on a more suitable deliverable grade of wool, it may have had a better chance of success.

imbalances lead to sharp price movements up or down. The cash settlement feature of futures contracts makes closing out positions substantially simpler. Traders can eliminate the basis risk associated with closing out their positions.

Finally, since actual delivery is unnecessary in a cash settlement contract, conventional types of manipulation such as corners and squeezes are unfeasible. Consequently, Gray (1982) argued that the cash settlement should replace the conventional delivery contract when manipulation problems were severe. Although the cash settlement method was innovated to apply to index based financial futures, Purcell and Hudson (1985) have contemplated its wider application to commodity markets.

Cash settled futures contracts must be based on an index, and so price information is required to form the index. This price information may be obtained from any relevant source, but if the information source is neutral, traders are more likely to “trust” the information. Therefore, government agencies are the best information source.

#### **4.7.5 Homogeneous Element**

Although the essential elements of the previous discussion on homogeneity still apply, a number of changes have been made. It is still necessary for futures contracts to state a standardised description so that buyers and sellers know with certainty what they are required to deliver or receive. However, the asset may be somewhat heterogeneous within the description. In many cases it is impossible to avoid a description with broadly defined specifications. For example, the live cattle futures contract has been very successful, but live stock comes in a number of different shapes, sizes, weights, breeds, and quality. Many other agricultural commodities, metals, and financial assets also come in varying degrees of quality and differing specifications. The important attribute of the asset description is not that it is totally homogenous, but rather that it is able to be “scientifically described” in well defined guidelines so that units of the asset may be traded on the basis of physical description — “sight unseen”.

In respect of financial futures, some contracts have no problems with the homogenous element. One U.S. dollar of foreign exchange is exactly identical to another. Nevertheless, financial futures have led to the development of the premium/discount method which allows grades other than the contract (or basis) to be

delivered. Where a premium/discount system is used, the futures contract is still priced off the contract grade, but the deliverable supply is increased.

Where a grade different from the basis grade is deliverable, three systems can be used to determine the amount of the premium or discount. First, the commercial difference system permits non-contract grades to be delivered at a premium or discount based on daily changes between grades in the spot market. Second, the fixed difference system, which is more common, allows the terms of the contract to specify the exact amount to be paid if the non-contract grade is delivered. The fixed differences are reviewed from time to time, so as not to become too far out of line with differences existing in the spot market. A previous Sydney Greasy Wool contract fixed differences for contract delivery in a given month on the first day of that month. Third, the hybrid difference system can be found in a small number of futures markets. Under this system, premia and discounts are still calculated according to grade, but are based in units of the commodity rather than cash. For example, the New York hides contract provides that a delivery may be made for a smaller net weight of superior hides, a larger net weight of inferior hides, or 40,000 lbs of basis grade hides, and all will attract the same payout.

#### **4.7.6 Preceding Existence of Forward Contracting**

Evidence that this prerequisite was unnecessary was first provided in 1969 when the plywood contract was developed without the existence of a preceding forward market. Subsequently, a number of financial futures have been developed which have not had preceding forward markets either, let alone had forward markets which have failed. Even although forward contracting has been and still is active in foreign exchange, there has never been a forward market on equity indices nor on bonds.

### **5. Contract Characteristics**

#### **5.1 Introduction**

Many of the exceptions to contract feasibility described immediately above arose out of specific instances of innovation. As this began to occur, researchers recognised that the design and ultimate terms of the contract were very important to success. Essentially, the measure of success was high trading volume, and therefore the factors

that draw volume are deemed by this area of research to be most important to successful innovation. The studies listed in Table 4 detail the work of a number of researchers who have used a case by case analysis of success and failure. Their research can be separated into three sections: attracting hedgers, attracting speculators, and preventing manipulation.

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**TABLE 4: FUTURES CONTRACT SUCCESS STUDIES**

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<i>Author (s)</i>	<i>Study</i>
1. Powers (1967)	Changes made to stimulate the frozen pork bellies futures contract.
2. Gray (1970)	Prospects for trading in live hog futures.
3. Sandor (1973)	The process leading to the development of plywood futures.
4. Goshay and Sandor (1973)	Prospects for trading reinsurance futures.
5. Sandor and Sosin (1983)	The process leading to the development of the first interest rate futures market.
6. Silber (1981)	Considers the futures markets for Silver, Gold, and GNMA's to illustrate the difficulty in determining success.
7. Amundsen and Singh (1992)	Considers the development of a futures market for electricity in Europe.
8. Buck and Hauser	The feasibility of a futures market for Barge Grain Freight.

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## **5.2 Attracting Hedgers**

The contention that trading volume is determined by the amount of hedging benefit has been examined and many factors which attract hedgers to futures markets have been considered.<sup>36</sup> The most convincing piece of affirming evidence concerning the attracting hedgers was provided by the decline in volume of wheat trading on the Kansas City Board of Trade following changes in the delivery provisions of the contract. In 1940, the contract provisions were changed to allow for the delivery of soft wheat, in addition to hard wheat which had previously been the only type allowed. Contract users continued to price, and deliver, only hard wheat, because of relative prices between the two types. In 1953, price relationships shifted and soft wheat became the cheaper deliverable variety. Long hedgers of hard wheat unexpectedly lost money as the movement in futures prices no longer reflected the movement in hard wheat cash prices.

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<sup>36</sup> A number of researchers have debated this point, for example, at various dates, Working, Gray, Telser, Cornall, and Bhattacharya *et al.*

Subsequently, traders of the hard wheat contract shifted their business to the CBT which offered a more suitable contract. Subsequently, volume at Kansas dropped dramatically.

Hedging will be most effective when there is a very predictable relationship between cash and futures prices. To achieve this, a futures contract should be designed for effective merchandising, that is, the making or taking delivery of the physical commodity. Therefore, the operation of the futures contract and the operation of the underlying market should be as similar as possible. For example, a successful futures contract will call for a delivery unit which is specified in the same way as contracts in the underlying market (Gray, 1970, and Sandor, 1973).

Powers (1967) established the importance of contract terms in attracting hedgers to the pork belly market. He found the reason why the contract was not well traded initially was because the original contract provisions did not reflect trade practices with regard to shrinkage allowance, storage time limits, method of storage and grading specifications. Hedgers dissatisfied with the original contract refused to trade the contract and it was not until the contract was revised that trading started to surge.

The costs of hedging (for example, brokerage and the difference between the bid and the ask prices) must be given careful consideration. Acheson and McManus (1979) consider that one factor leading to the success of a contract is the cost of hedging. If hedging is too expensive the benefit obtained from the reduced risk may not warrant the expense. Effectively it is a cost/benefit analysis to decide to enter the market.

### **5.3 Attracting Speculators**

First, speculators are crucial to the success of the futures markets because they provide greater liquidity to the market, which results in lower transaction costs for all through the narrower bid-ask spread that more liquid markets have.

Second, speculators are also necessary to absorb the net long or short of hedgers positions that would otherwise create large price biases (Gray 1960, 1961, 1966). A lack of speculators in this context can easily led to the demise of a contract if one side of the market has a greater number of traders than the other.

Gray (1961) considered the role of speculators in three wheat markets — Chicago, Kansas City and Minneapolis, and concluded that “[a]ll futures markets depend upon

hedging for their existence,” (p. 22) or more particular, “open interest in futures markets depends upon hedging”; however, he also concluded that “hedging depends upon speculation” (p. 24). Gray observed that the smaller sized markets of Kansas and Minneapolis actually traded the preferred contract because of delivery location and the specific variety of wheat. However, Chicago, which traded three quarters of all wheat contracts traded, possessed most of the speculation and a broader range of deliverable varieties. At the two smaller exchanges, there would quite often exist an imbalance of hedging orders, that is, where shorts did not equal longs. When this occurred prices would deviate from their normal parallel movement with Chicago. Clearly this deviation would raise the hedging costs at the smaller markets, and this resulted in hedgers shifting their business to Chicago. This conclusion is very important. The better constructed hedging contract at the smaller exchanges was not always worth the increased cost of trading in that market. Gray concludes that the inability of the smaller two exchanges to accommodate their hedgers because of a lack of sufficient speculation would have ordinarily doomed them to failure, but they survive because the deviation does not get too large due to professional spreading speculators who respond to disparities by taking positions in both markets.

Silber (1981) studied a number of examples of contract modification which attracted more speculation and resulted in better success. First, he noted that all contracts on the Mid America Commodity Exchange were proliferations of contracts traded elsewhere, but were usually smaller in size. The smaller size was aimed at attracting speculators with limited capital. Because the smaller market did not provide a superior price discovery role, their success proved the value of their role in reducing indivisibilities. Second, Silber observed how a proliferated contract of smaller size succeeded. Futures trading in silver was concentrated on the Commodity Exchange Inc., prior to 1969. In November 1969, the CBT introduced a contract that differed only in that it called for 5,000 instead of 10,000 troy ounces. The contract was an immediate success, and it traded 559,000 contracts in the third year.

Finally, because speculators derive their profits from trading on information, they will only be attracted to markets where information flows regularly and reliably. It will also be advantageous if information becomes publicly available for all traders at the same time.

Gray (1966, p. 122) summarised the situation with respect to hedging and speculation, and why some “Futures Trading Succeed[s] or Fail[s]”:

The first prerequisite to the success of a futures market is hedging use. There must be a reason for commercial buyers and sellers of the commodity to want to substitute futures contracts temporarily for merchandising contracts. The reason may be financing of inventories, forward pricing, or shipping convenience. Typically some combination of these reasons will have already given use to some kind of time contracts. In order to appeal to hedgers, the contract, delivery terms, months and locations must all conform closely to commercial movement. Secondly, the market must attract speculation, chiefly to offset the tendency for short hedging to exceed long hedging. When these two conditions are met, a market can grow to its optimal level and continue over a long period to provide balanced price estimates.

#### **5.4 Preventing Manipulation**

Traders will not use a contract if there is a real possibility of substantial manipulation. Therefore it is necessary to design a contract that is difficult to abuse. Gray (1966, p. 117) found that contracts whose original provisions “favour the buyer or seller, enabling one side to squeeze the other as the delivery date approaches” often end in failure or are revised (Goss, 1972, also concluded this).

This problem normally arises when the deliverable commodity is in short supply in the cash market, because holders of large long positions can recognise this situation, and stand for delivery. Holders of short positions can attempt to buy futures or the deliverable commodity, but both will drive up prices and distort the normal price relationship, and create substantial gains for those holding long positions at the expense of those with short positions.

The main method of reducing the likelihood of market manipulation is to increase the volume of the deliverable variety. This may be achieved by specifying a broader range of deliverable varieties or by allowing delivery at a greater number of locations.

If a broader range of deliverable varieties is the accepted method it is usual to formulate a system of premiums and discounts to allow for the difference in value between varieties in the cash market. This system has been considered in Part II.

Although this addresses the problem of manipulation, it is not always recommended because there is a trade off between achieving increased volume (through allowing a greater number of varieties to be delivered) and hedging effectiveness (which is the



ultimate goal). Hedging effectiveness requires a high degree of price correlation between the futures and cash prices. To achieve the highest possible correlation, a contract calling for delivery of a single grade is best. This is because there is no uncertainty about the deliverable grade, and therefore convergence at settlement will always occur. However, if a contract calls for multiple varieties, there will be uncertainty about the grade that will ultimately be delivered as sellers will always attempt to deliver whatever grade is cheapest at the time of delivery. However, fluctuating prices among varieties subject traders to the risk that the variety priced by the futures at the time of purchase will not always be the variety priced at selling time or priced and delivered at settlement.

### **5.5 The Marketing Problem**

It is clear that contract design is important to the success of a new futures contract. A poorly designed contract that, for example, does not attract speculators or could be subject to manipulation, will lack the necessary appeal and fail to attract sufficient trading volume. In this sense, contract design for the exchange can be described as a basic marketing problem (Silber, 1981).

The design problem centres on all contract specifications, and Silber (1981) found a surprising sensitivity of a new contract's success to relatively minor changes in contract specifications. Four similar gold contracts were listed in 1975. One called for the delivery of 1 kg gold bars, one for 3 kg gold bars, and the other two for 100 oz gold bars. Only the 100 oz contracts succeeded despite the fact that the 3 kg contract was offered on the more capitalised floor of the CBT. The 100 oz contract appeared to succeed for the simple reason that this unit size simplified calculations, and therefore enabled arbitrageurs to respond more rapidly to price discrepancies.

## **6. Conclusion**

Although the topic has been researched, and despite the fact that the economic roles of futures markets have been well established, currently there is no theory of success for futures contract innovation.

Researchers first focused on characteristics that commodities with futures markets shared in common to determine which commodities could be feasible for futures

trading. However, this does not guarantee success and in fact the failure rate of innovation has been very high. Further, an anomaly exists in that one commodity of seemingly similar pairs often enjoys a successful market where the other does not, and as new contracts have been successfully introduced, traditional prerequisites have been rendered obsolete. Only three characteristics have remained important over time: price variability, large cash market, and competitively determined prices. For these reasons it is clear that contract feasibility is not the same as success.

Volatile prices in the underlying market are necessary because they cause price risk, and price risk is essential if a futures contract is to provide hedging benefits. If there is no hedging benefit the contract will fail because there will be no hedging demand. Similarly, speculators will not trade the contract if there is no movement in prices because there will be no possibility of financial gain.

A large cash market is important for five reasons. First, the larger the number of participants in the cash market and the larger the volumes traded, the larger the interest in futures trading, and hence the greater the likelihood of success of the futures market. Second, larger markets result in higher levels of liquidity, and hence the convergence of cash and futures markets will be enhanced. High levels of liquidity also lower trading costs. Third, market manipulation cannot occur as easily if supply and demand is large, in proportion to individual interests. These points are important in the context of the market size of the deliverable commodity. Fourth, market structure is important, because, for example, if the industry is geared to deal with price risk through vertical integration, the demand for hedging will be non-existent. Finally, the size of the cash market is important in terms of both volume and value.

The underlying commodity must flow naturally to a competitive and unregulated market with low delivery costs. The price must be determined only by competitive supply and demand forces. The market must be free from control by government, cartel or monopolist. If there are no transaction costs in a competitive market, any derivation in the futures and cash price will be arbitrated away, and the futures and cash market prices will converge on settlement. This will increase hedging benefits, and so it is necessary that delivery, and other transaction costs, are as low as possible, or that delivery under the futures contract incurs only the same cost as would be incurred if the commodity was sold using normal marketing practices.

There must be a real possibility of arbitrage if the futures and cash market prices are to converge. Traditionally, it was considered that this process required that the owner of the underlying commodity must be able to make a choice between selling in the present, or holding the commodity for latter sale. However, the commodity need not be storable (although the advent of refrigeration technology has enabled many previously perishable commodities to become storable and hence suitable for futures trading). All that is necessary is that supply will become available in the future (in this case the futures price will provide the best possible estimate of the future cash price based on currently available information on future supply and demand). In this situation the delivery instrument is a “call on production” rather than a “warehouse receipt”.

Further new delivery innovation was made with the advent of “cash settlement” which has a number of advantages and disadvantages. First, because a cash settled contract, by definition, will converge on the cash market price, hedging effectiveness will be enhanced. Other arguments exist for and against the ability of cash settled contracts to lower basis risk, but hedging demand will almost certainly decrease if potential participants have difficulty in applying pricing methods to this type of contract. Second, there may be cost savings because of the elimination of expensive physical delivery. Third, expiration day volatility will be reduced, and finally, conventional types of manipulation are not feasible with a cash settled contract.

The element of homogeneity has changed considerably over time. It is important for futures contract specifications to state a standardised description so that buyers and sellers know with certainty what they are required to deliver or receive. But the asset described need not be a totally homogeneous commodity. It is necessary only that the asset is able to be “scientifically described”, in well defined guidelines, so that the units of the asset may be traded on the basis of physical description — “sight unseen”.

As many of the exceptions which have been made to traditional prerequisites arose from specific instances of innovation, modern research has focused on contract characteristics as determinants of successful innovation. Researchers recognised that the design and ultimate terms of the contract were very important to success. Essentially, the measure of success is high trading volume, and therefore factors which contribute to demand must be considered.

Hedgers must be attracted to the market. The demand from hedgers will arise only if the hedging benefits of the futures market outweigh the costs or alternatives. So all components of this equation must be considered. The main elements to consider are the remaining three commodity characteristic prerequisites of futures trading, but these must be considered from the prospective of potential hedgers. This will mean that the level of volatility must not only be significant in the eyes of the innovating exchange, but also be considered significant in the perception of potential hedgers, the relationship between cash and futures prices must be predictable by hedgers, and the contract must be designed for effective merchandising.

Speculators are critical to the success of a futures market, because they provide additional liquidity to the market, which lowers transaction costs. Second, speculators absorb the net long or short positions of total hedgers' positions.

Traders will not use a contract if there is a real possibility of substantial manipulation, so it is necessary to design a contract that is difficult to abuse. In particular, a contract must not favour one side of the market.

In conclusion, there is no available theory which will guarantee successful futures contract innovation. Designing successful contracts is something of an art, and is essentially a marketing problem for exchanges. However, contract success is measured by trading volume, and therefore in designing a successful contract, all elements which affect the demand for that contract must be considered. A successful contract will be designed to attract maximum demand.

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**PART IV:**  
**THE NEW ZEALAND FORESTRY INDUSTRY**

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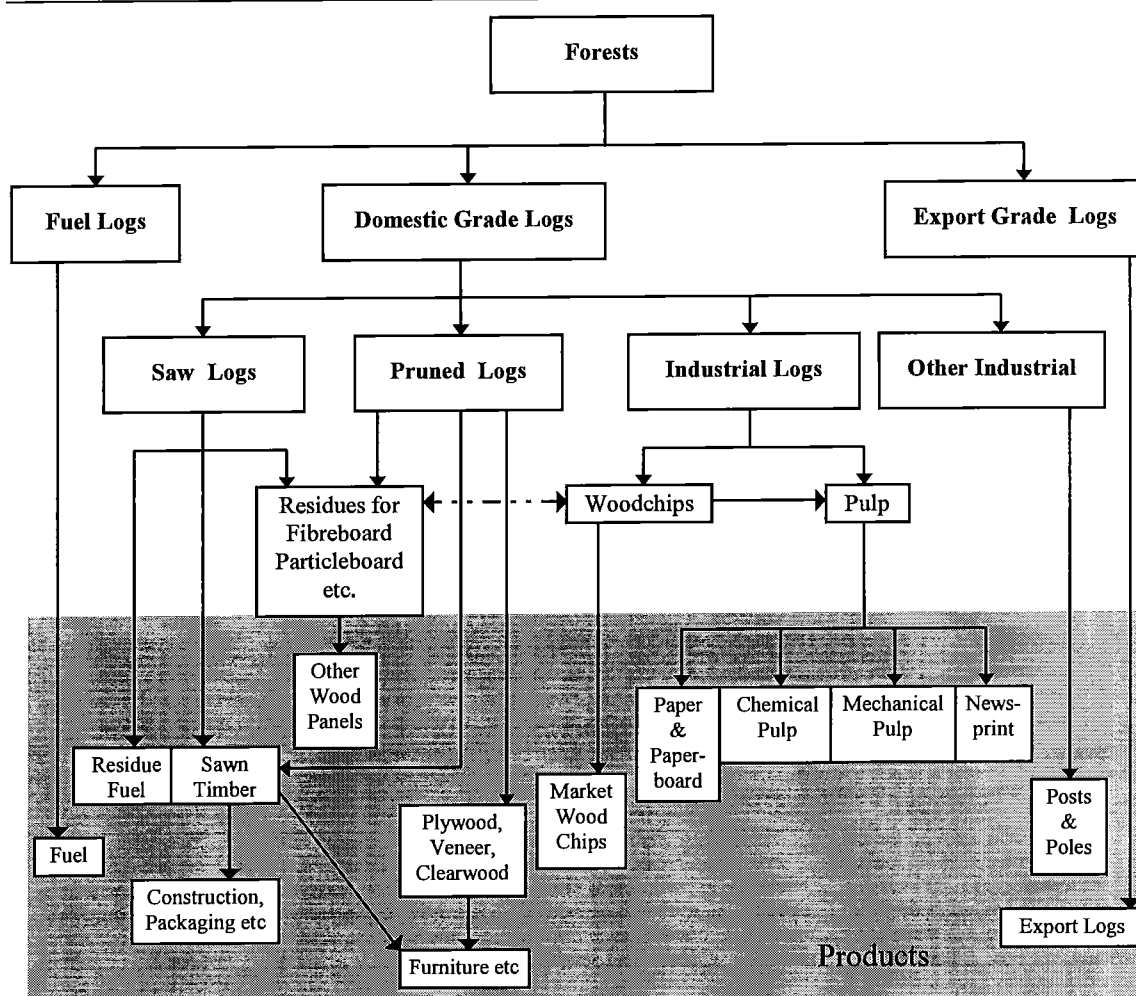
## **1. Introduction**

Having established the operation of futures, their economic roles, possible detrimental effects, and factors leading to successful innovation, it is necessary to consider the forestry industry in New Zealand and in the world. This requires an overview of the industry, and in depth studies of the commodity characteristics of the industry's main outputs, and the elements which affect supply and demand. This will provide an insight into what sub-markets exist and the size of these markets, the dynamics affecting supply and demand and ultimately price, and the homogeneity of the commodities of the sub-markets. These are essential considerations for the development of a successful futures market.

## **2. An Introduction to The New Zealand Forestry Industry**

### **2.1 Overview**

As graphically represented by Figure 4, the forestry industry can be structured into a number of sub-industries which produce different products but all share in common the same raw material — wood fibre. The raw material removed from forests can be classified into different groups (fuel, domestic, and export logs), and can be further categorised into groups depending on which market they are consumed.

**FIGURE 4: OVERVIEW OF THE FORESTRY INDUSTRY — STRUCTURE AND PRODUCTS**

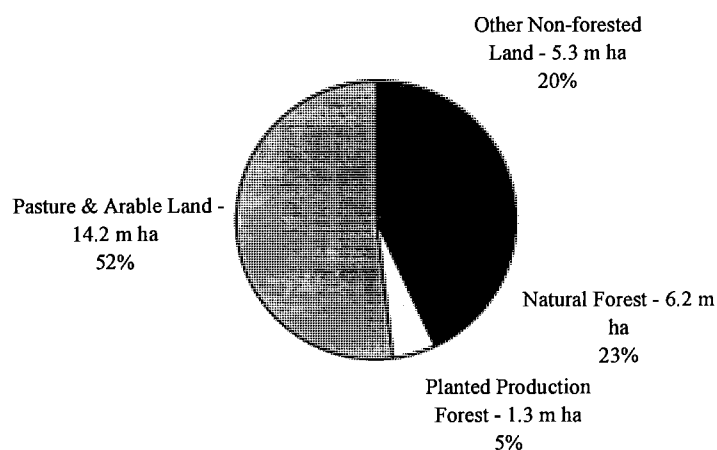
Source: Edger, *et al*, 1992, p. 3.

## **2.2 New Zealand Forest Lands**

Figure 5 reveals that natural forests cover 6.2 million hectares, or 23 %, of New Zealand's 27 million hectares of land area. Planted production forests, forests that are managed on a sustainable yield, cover 1.3 million hectares, or 5 %. It is estimated that 3-5 million hectares of pastoral land would be more suitable to planted production forests (Ministry of Forestry, 1992a, p. 4).<sup>37</sup> Planted production forests, although smaller in total area size, provide most of the harvest. They meet over 95 % of New Zealand's domestic timber needs.

37 However, this estimate would depend partly on revenue from planted production forests, which was very good during parts of 1992 because of high log prices.

**FIGURE 5: NEW ZEALAND LAND USE ALLOCATION**  
**(Total Area 27.0 Million Hectares)**  
**(1993)**



Source: New Zealand Forest Owners Association Inc, *Forestry Facts and Figures 1994*, 1994, p. 2.

The standing volume of timber in New Zealand's forests as at 1 April 1993 was estimated at 256 million m<sup>3</sup> (Ministry of Forestry, 1994a, p. 9) with an annual increment estimated at 22 million m<sup>3</sup> (Ministry of Forestry, 1993a, p. 6). Roundwood removals for the year ended June 1994 were 15.8 million m<sup>3</sup> (Ministry of Forestry, 1994d).

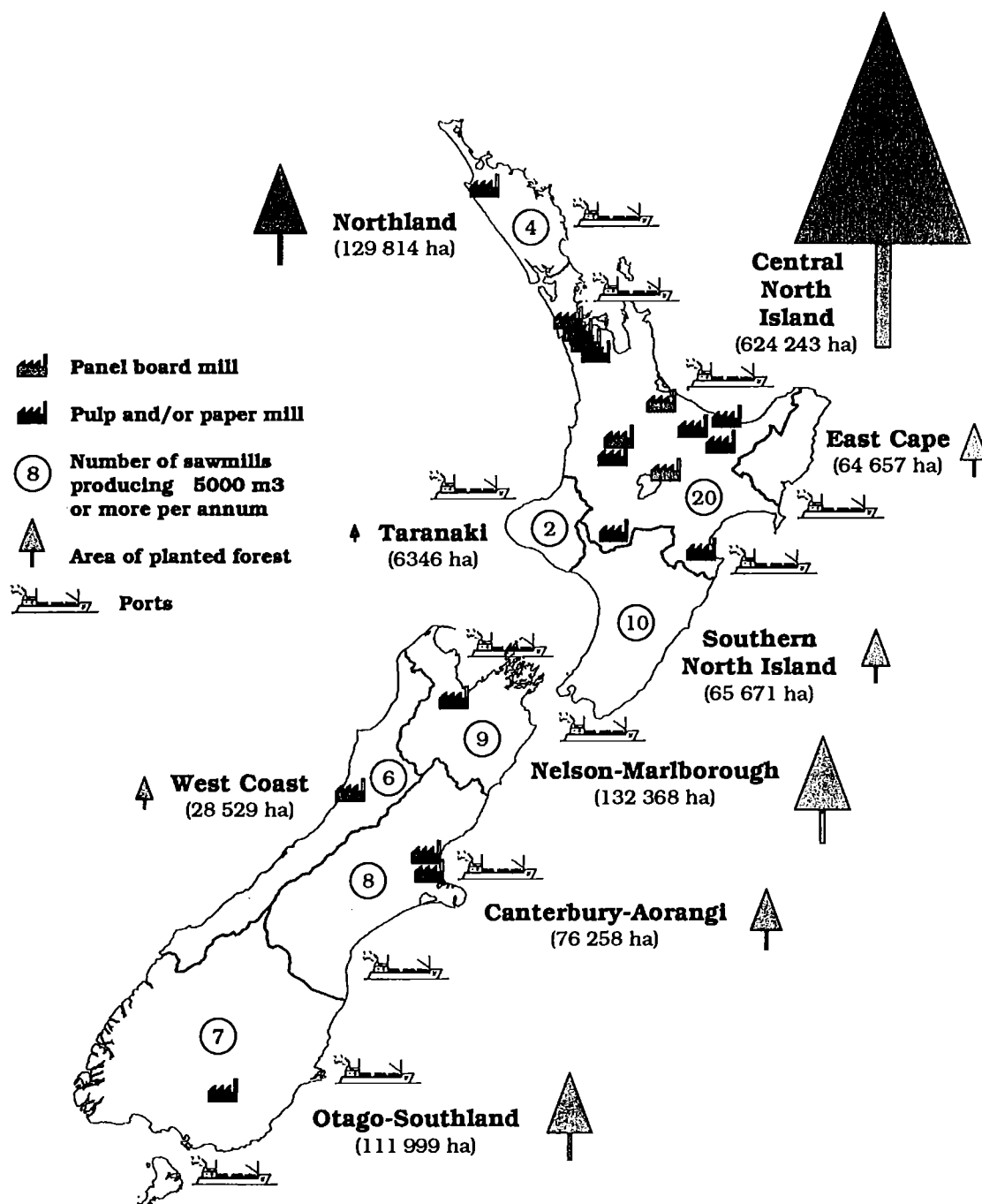
New Zealand's planted production forests are located throughout the country, and extend from coastal sites through inland areas to the high country. The bulk of the forest estate is contained within relatively few large forests, but recently the number of smaller holdings has increased (Ministry of Forestry, 1993a, p. 4).

The biggest concentration of plantations is in the central North Island, where 40 % of all planted production forests lie. In fact, 71 % of all planted production forests are in the North Island. The biggest concentration is on the volcanic plateau and in the Bay of Plenty. It was there, on land that was unable to support livestock due to a cobalt deficiency, that Kaingaroa, now New Zealand's biggest single area of plantation forest and one of the largest in the world, was established. The central North Island has easy terrain, high productivity soils, necessary infrastructure, and proximity to ports and ultimately markets, which makes it one of the most profitable areas to forest in New Zealand and the world. This is geographically represented in Figure 6 which shows the



regional distribution of planted forests and processing infrastructure (Ministry of Forestry, 1993a, p. 4).

**FIGURE 6: REGIONAL DISTRIBUTION OF PLANTED PRODUCTION FORESTS AND PROCESSING INFRASTRUCTURE**



Source: Ministry of Forestry, *New Zealand Forestry Investment Opportunities*, unknown date of publication, p. 3.

### **2.3 Production Species**

Table 5 details the tree species which are grown in New Zealand. Almost 90 % of production forests are planted in a single species, *pinus radiata*, commonly known as “radiata pine”. Radiata pine is a native of California, and was brought to New Zealand around the late 1940s. It grows extremely well in New Zealand conditions, responding well to a variety of soil types, altitudes and climatic conditions (Ministry of Forestry, 1992a, p. 5).

The seed of radiata pine is easily collected and germinates quickly. Seedlings are easy to produce in a nursery and have a high survival-rate. Radiata pine responds well to thinning, and pruning wounds heal quickly. As a result of these features, radiata pine plantations are relatively cheap, and easy to establish and manage (Ministry of Forestry, 1992a, p. 5).

Radiata pine is a highly marketable product for a number of reasons. The timber is easy to dry, machine and treat with preservative. It has good nailing, gluing and painting properties and is a versatile timber suitable for furniture, moulding, construction and packaging. It can be sliced or peeled for veneers, and plywoods, and can be treated for use in the harshest environments. It makes excellent high strength pulp and paper, and particleboard (Ministry of Forestry, 1992a, p. 5).

**TABLE 5: PLANTED PRODUCTION FOREST AREA BY SPECIES**  
(AS AT APRIL 1993)

<i>Species</i>	<i>Hectares (000)</i>	<i>% of Total</i>
Radiata pine	1,203	89.8
Douglas Fir	67	5.0
Other Exotic Softwoods	39	2.9
All Exotic Hardwoods	30	2.2
Total	1,339	100.0

Source: Ministry of Forestry, *A National Exotic Forest Description*, 1993a, Table 1, p. 10.

### **2.4 Sustainable New Zealand Forests**

Planted production forests are defined as those that are managed on a sustainable yield. That is, a certain volume of wood can be harvested from a planted production

forest into perpetuity, and this harvest volume is equal to the average annual volume increment of the total forest.

New Zealand made an early move to plantation-based forestry and is now a world leader. This country recognises that the entire cycle from seed to market must be considered if the industry is to survive in the long term. Further, arguments promoting environmental care also advocate sustainable forestry resources. New Zealand's "clean green" image is often used to promote products in international markets, and the environmental benefits of sustainable production forests have enhanced this image.<sup>38</sup>

The principles of renewability and sustainability have been legislated in the *Resource Management Act 1991* to ensure that all businesses adhere to the principle of sustainable management of natural and physical resources. Nelson and Business Media Services Ltd (1994) produced a strategy study for enhancing the sustainable use of New Zealand's land resources. It describes an accepted strategy for the establishment, maintenance, and use of forests. The strategy does not set specific policies, but rather defines a framework which will guide those who have these responsibilities in considering long term timber needs, and protecting water resources, landscapes and historical sites, representative ecosystems, and native plants and animals. The aim is to reduce the costs and impacts associated with land related problems of individual producers and communities (Ministry of Forestry, 1993a, pp. 21-31).

The New Zealand Forest Code of Practice also encourages forest owners to plan, manage and carry out forest operations in a sustainable manner. Linking this code with other guidelines provides forest owners with an effective means of achieving the desired environmental outcomes required by the *Resource Management Act 1991* (Ministry of Forestry, 1993a, pp. 21-31).

The *Forests Amendment Act 1993* legislates sustainable management of natural forests which are privately owned. New Zealand has 6.2 million hectares of natural

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38 The essential environmental benefits of forestry are: soil, air and water protection, soil erosion and flood damage protection, animal shelter and habitats, recreational opportunities, and the reduction of the greenhouse effect because forests act as a "carbon sink".

Forestry also has harmful effects, such as soil disturbance caused by harvesting, and chemical contamination of land and waters as a result of processing (Both these areas are continually being researched, and new and improved ways to reduce these harmful effects are being developed).

forests, and approximately 21 % of this land is privately owned. In July 1993 the *Forests Amendment Act 1993* was implemented to promote the sustainable management of this privately owned proportion of natural forest.<sup>39</sup> Essentially, the act requires sawmills that wish to mill indigenous timber to be registered with the Ministry of Forestry; and these sawmills will be able to mill indigenous timber only if it is harvested under an approved sustainable forest management plan or permit. The act also prohibits the export of indigenous woodchips and logs. The export of sawn timber will be permitted only if it is of the rimu or beech variety, and has been harvested under a registered sustainable forest management plan or permit (Ministry of Forestry, 1993a and 1993b).

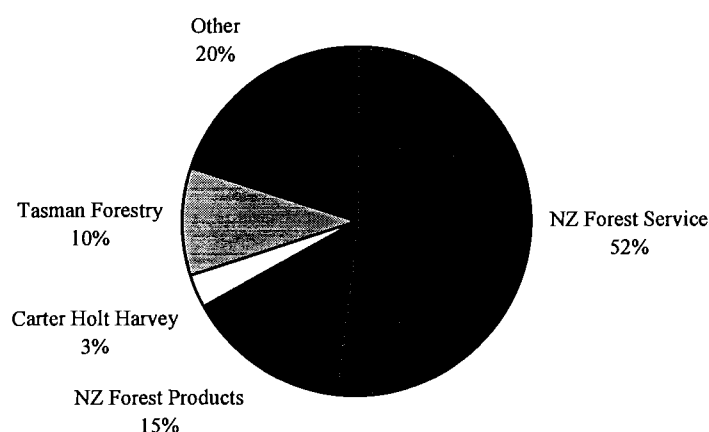
## **2.5 Ownership**

In the past the bulk of the forests has been owned by a small number of investors and the government. In 1987, the three largest owners possessed just under 30 % of the resources, and the New Zealand government, through the New Zealand Forest Service, owned just over 50 %. This is shown in Figure 7.

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**FIGURE 7: OWNERSHIP OF NEW ZEALAND PLANTED PRODUCTION FOREST AREA  
(1987)**

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Source: Ministry of Forestry, *Forestry Sector Issues*, 1993a, p. 39.

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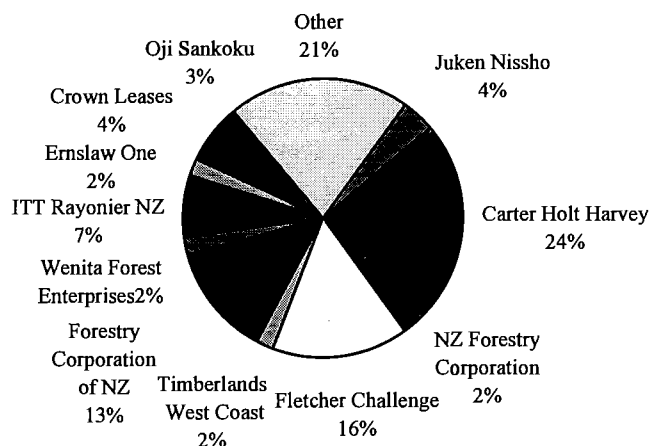
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39 The act covers all indigenous forests except West Coast Accord forests, forest on land reserved under the South Island Landless Natives Act 1906, forests administered by the Department of Conservation and planted indigenous forests.

As described in Part II, at p. 29, the New Zealand Government in 1984 chose to reduce day-to-day involvement in the economy. This led to extensive state sector privatisation and market liberalisation. The forestry sector was restructured in 1987, and three new entities were formed:

- Ministry of Forestry,
- Department of Conservation, and
- New Zealand Forestry Corporation.

**FIGURE 8: OWNERSHIP OF NEW ZEALAND PLANTED PRODUCTION FOREST AREA (1993)**



Source: Ministry of Forestry, *Forestry Sector Issues*, 1993a, p. 39.

Privatisation has had a major impact on the ownership structure of the industry. In 1989, following privatisation, 550,000 hectares of Crown forests were sold under the *Crown Forest Assets Act 1989* by public tender and negotiation. Further, sales commenced in early 1992 when 97,000 hectares were sold by public tender. This has resulted in the ownership of the total resources by the private sector rising from just 48 % in 1987, to 83 % in 1993. The unsold Crown forests are currently managed by three state enterprises:

- Forestry Corporation of New Zealand,
- Timberlands West Coast, and
- New Zealand Forestry Corporation.

The current ownership situation, diagrammatised in Figure 8, indicates the large stakes of several huge private companies, and the minimal ownership of resources by the government.

## **2.6 Investing in Forestry**

Broadly, there are three categories of forestry investment:

- Listed forestry stocks. For example, Fletcher Challenge, Carter Holt Harvey, Nuhaka.
- Issues to the public through professionally organised forest partnerships, or limited liability companies, which are not listed. For example, Roger Dickie (N.Z.) Ltd's Aberdeen Forest Partnership, and Forest Enterprises Ltd's "Lowlands Forest Investment".
- Private investments.

### **2.6.1 Listed Forestry Companies**

Listed forestry companies are often considered the safest form of forestry investment. The advantages are:

1. They are highly liquid.
2. The investment size is fully flexible.
3. The investment has positive diversification capabilities in a share portfolio.

The risk premium applied to forestry stocks ranges from 1.5 % to 3.5 %, and depends on factors such as:

1. The size of the company.
2. The management structure.
3. The liquidity of the shares.
4. The maturity and quality of the forests.
5. The age class of the forest.

This generally results in a real post-tax discount rate of between 9.5 % and 11.5 %, based on a risk free rate of return equal to 8 %. Actual rates which tend to be in use range from 8 % to 10 % which reflects an intermediate term bond.

### **2.6.2 Forest Partnerships and Limited Liability Companies**

Offers to the public though unlisted floats including partnerships, trusts, and qualifying companies have become popular over the last few years. Interest in this type of forestry investment has increased because of an acknowledgment of several factors by the investing public (This section is based on details provided by the New Zealand Forestry Exchange, and the writer acknowledges the assistance of Bruce Koller):

1. Recognition of the need to provide for one's own superannuation has kindled renewed interest because forestry is one of the few proven long term successful investments available.<sup>40</sup>
2. Specifications of the investment parallel superannuation requirements.<sup>41</sup>
3. Forecasts of world demand and supply have recognised a future shortage of timber (this factor is considered shortly). Investors recognise that this will clearly stimulate log prices, and are only recently becoming more aware of this fact.
4. New Zealand is deemed to be in an excellent position to take advantage of these log price increases as it is blessed with comparatively faster growth rates, which means that production can be increased to meet demand in 30 years, whereas other countries, with comparatively slower growth rates, may not.
5. This type of investment allows owners to become easily informed of factors directly affecting the value of the forest. For example, the location of the forest, extractability of the wood for the site, the

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40 Ministry of Forestry statistics show investors that over the past 40 years prices paid for logs have moved ahead of inflation providing capital protection, and these investments have yielded a significant return on investment.

41 Briefly, forestry investment involves cash injections during establishment and tendering phases, usually the first eight to twelve years. Under current legislation, the investment provides the investor with taxation benefits during this time, but no assessable income is derived until the crop is harvested. This may be timed to occur during early retirement when income may have been reduced though loss of salary.

proximity to a port, and professionalism of management (and in particular, managements records of forest operations).

6. This type of investment also allows economies of scale through investor aggregation (this will reduce the costs of planting, maintaining, harvesting the forest, and marketing logs); provides for, but does not necessarily require, investor involvement; and provides the investor with direct taxation benefits.
7. The investment does have some liquidity as discussed later.

There are, however, several disadvantages:

1. Liquidity is lower than listed shares, even although the forestry holding is marketable.
2. Overhead costs are high (as a result of promotion fees, prospectus costs and statutory supervision costs) in comparison with private investments and listed forestry companies.
3. Flexibility of the size and timing of investments is low as these are set by the promoter.

Limited Liability Companies appear to have some advantages over partnerships:

1. The proceeds from the sale of an investment unit during the term of the project may not be taxable, as they could be treated the same as the proceeds from the sale of any company shares.
2. The number of people able to participate in a single forestry venture is unlimited. This compares with partnerships which are allowed a maximum of 25 partners under the *Partnership Act 1908*.
3. A limited liability company, as the name suggests, limits the liability of shareholders to their capital contribution. This compares with partnerships which have unlimited liability.
4. Because investors own a company their shares are easily transferred at minimal cost, unlike the transfer of forestry partnership units which tend to be more complicated and attract tax on the sale proceeds, plus stamp duty on the value of the land and trees.



Prospectuses for these types of investments quote discount rates or internal rates of return (IRR) ranging from 10 % to 12 %.

### **2.6.3 Private Investments**

The discount rate used to value private forest assets is likely to be higher than that applied to listed forest companies, unlisted companies, and partnerships, because investors perceive higher risks:

1. There is a perception that liquidity is lower for individual stands of immature trees.
2. There is usually less public information available about such forests and their management.
3. The quality of planting, silviculture, and general management of privately owned forests tends to be particularly variable.
4. Financing is often more difficult.
5. There can be recourse against a forestry promoter, particularly under the *Fair Trading Act* 1986.

Most investors, therefore, apply a discount rate well above those quoted for partnerships and unlisted limited liability companies of around 12 % to 15 %. An experienced forestry investor may apply a lower discount rate than this for a good forest, but for forests which are not so good (for example, ones which are located far from a port, face access and harvesting difficulties, or have been poorly maintained) a higher discount rate may be applied to reflect their lower value.

## **2.7 A Secondary Market for Forestry**

A secondary market for trading immature forests has been formed as a result of many smaller forest owners now owning as much as 30 % of New Zealand's total forestry resources. The secondary market has been named "The New Zealand Forestry Exchange" by its owners Nimo-Bell & Company Ltd,<sup>42</sup> and was developed during 1994.

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42 Nimo-Bell & Company Ltd is one of New Zealand's leading primary sector business and consultancy firms, and has been operating in the primary sector for the past four years.

Although the need for the development of a secondary market has existed for several years, development has not been possible because:

1. There existed several legal impediments for which a solution has only just been devised.
2. No single body existed in New Zealand which had the necessary knowledge.
3. Private investors have only recently gained the confidence to invest in forestry where all the necessary financial details are provided by promoters. Further, time has been required for them to develop the confidence to invest in immature forests.

Therefore, resolving these issues and developing investor confidence has been essential in the creation of demand, which is necessary to make an exchange work. The forestry exchange recognised that in order to develop investor confidence it is necessary to provide an accurate description of the forest which is for sale. Potential buyers are conscious that many forest descriptions lack consistency and do not always cover key points, such as:

1. Establishing data (with particular emphasis on the net stocked area) with sufficiently high confidence levels.
2. Detailing silviculture history and the quality of the stand.
3. Assessing the potential impacts of the *Resource Management Act 1993*, and other local body regulations.
4. Assessing roading, and many other future costs, and the risks which may have an impact on eventual returns.

To deal with these problems the exchange has developed a standard method of describing a forest. This, however, must not be confused with a standard forest description. Unfortunately, no homogeneous standard forest exists. The standard method of describing the forest has been developed in conjunction with four other reputable forestry consultants, the Ministry of Forestry, and the Forest Owners Association. The description method not only overcomes the problems considered

above, but also has the advantage that a forest for sale may be compared against pre-determined quality standards and descriptive criteria. The exchange requires that the forestry description be prepared by a reputable forestry consultant, and this is a prerequisite for listing on the exchange.

The exchange is able to provide a number of alternatives in transferring the ownership of a forest resource. This flexible range of alternative transactions includes:

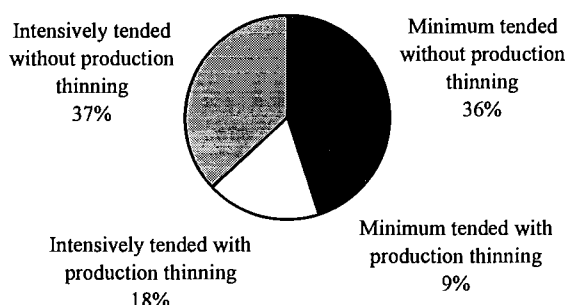
1. Sale and purchase of forest and land.
2. Sale and purchase of forestry rights (i.e. cutting rights to stumpage, but not ownership of land)
3. Sale and purchase of partnership or limited liability company interest, or establishment of one of these vehicles.
4. Sale and purchase of joint venture interest, or establishment of a joint venture.

## **2.8 Forest Management**

Forest management aims to produce an ordered, healthy forest of high value timber. New Zealand is a world leader in radiata pine planted production forest management. As Figure 9 reveals, 18 % of planted production forests are intensively tended with production thinning, and 36 % are intensively tended without production thinning. These percentages are increasing, with significantly higher proportions in the one to fifteen year age class compared to older age classes.

Sufficient numbers of seedlings are planted to allow trees to be thinned so that only an evenly distributed number of trees with superior form and size grow to maturity. Planting trees in a dense manner also provides for improved light branching and good form. A long term programme to genetically improve radiata pine has resulted in improved growth and form, and combined with better land preparation and establishment practices, this has reduced the number of trees that must be planted per hectare to achieve a healthy high-quality final crop.

**FIGURE 9: FOREST MANAGEMENT PRACTICE  
(1993)**



Source: Ministry of Forestry, *A National Exotic Forest Description*, 1993, Table 1, p. 10.

Young radiata pine trees are normally pruned in two or more stages, around the ages of four and ten years. When the tree matures, the “pruned” proportion has a low quality knotty core, but this is surrounded by high value defect free clearwood. This log is graded as quality P1/P2 (log grades are discussed in the next section). The effect of intensive pruning vastly improves the amount of this high quality grade. But, despite the influence of the growing regime, a tree (and hence forest) yields a composite of joint log products, not a single, homogeneous quality of log. The amount of each grade of log within a tree depends greatly on the timing of the harvest and the growing regime.

With forestry audits becoming increasingly popular, at some stage in the distant future it could be possible to define a standard tree (and hence forest) which would consist of an identifiable amount of logs in each grade. Forestry audits aim to achieve a standard mature tree by requiring forest managers to maintain a strict silviculture and management programme. However, the concept of forestry audits has only recently been developed, and as such only a few very young forests are growing under this scheme.

## **2.9 Summary**

The New Zealand forestry industry consists of a number of sub-industries which all share the same raw material — wood fibre.

Planted production forests cover 1.3 million hectares, or 5 %, of New Zealand’s 27 million hectares of land. Radiata pine is the predominant species constituting 89.8 %

of the planted forest area. These forests are managed on a sustainable yield — a certain volume of wood can be harvested from the forest into perpetuity. The biggest concentration of plantations is in the central North Island.

The standing volume of timber in New Zealand's forests as at 1 April 1993 was estimated at 256 million m<sup>3</sup> with an annual increment estimated at 22 million m<sup>3</sup>. Roundwood removals for the year ended June 1994 were 15.8 million m<sup>3</sup>.

Although the bulk of the forests have traditionally been owned by the New Zealand Government and a small number of large investors, since the forestry asset sales of the government there is now a much greater number of investors. The largest investor, Carter Holt Harvey, owns 24 % of the forestry resource; Fletcher Challenge owns 16 %, and nine other companies own a further 49 %, leaving 21 % to be held by a large number of small investors.

Broadly, there are three categories of forestry investment: listed forestry stocks; issues to the public through professionally organised forest partnerships, or limited liability companies, which are not listed; and private investments. To a large extent the two latter categories are accountable for the majority of new planting. Each category has a number of distinctly different attributes relating to liquidity, flexibility, etc. which is reflected in the risk and return of the investment. The flexibility of partnerships, non-listed limited liability companies and private investments is increasing as a secondary market for immature forests is established, which will increase the liquidity of such investments.

### **3. Commodity Characteristics and Marketing of Logs and Timber**

#### **3.1 Domestic Logs**

As stated, trees, and hence a forest, do not form a single homogeneous quality of log, but rather a composite of joint log products which may be graded into homogeneous classes. Many mills and large forest owners have set their own grades, although the New Zealand Forest Research Institute (NZFRI) has developed a set of standard domestic grades. Although this grading is a costly scientific process, it is necessary

because the difference in the value of different grades is significant, and consequently log grades are common terms in contracts trading logs within New Zealand.<sup>43</sup>

Logs may be classified into three main categories under the domestic grading system: industrial logs; saw logs; and pruned logs. These categories are divided into grades which may be scientifically described so that the log grades can be characterised as homogeneous classes of logs that may be traded on the basis of physical description — “sight unseen”. The characteristics which are used to specify different log grades scientifically include:

- Pruned or unpruned status (whether the log as part of the growing tree was pruned or not).
- Small end diameter (commonly referred to as the s.e.d., the small end diameter of a log is measured inside the bark).
- Large end diameter (commonly referred to as the l.e.d.).
- Branch size and nodal swelling (nodal swelling refers to an increase in the diameter of a log at the point where a cluster of branches (a node) occurs).
- Sweep (this is a measure of the bend in a log calculated as the maximum distance from a line drawn between two defined points on the surface of the log on the same axis (i.e., the two ends of the log) to the surface of the log directly below).
- Length.
- Internode length (the distance between two whorls (groups of branches growing radially around a tree) on a tree or log).
- Roundness and surface defects.

Table 6 provides the specifications of domestic log grades as classified by the NZFRI.

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43 If an entire forest is sold as stumpage it is normal for the price to be determined on some basis of the log grades which may be expected to be obtained from the forest, since this is what ultimately determines its value. However, logs may also be sold “run-of-bush”. This does not mean that a single log quality will be obtained from the forest, but rather that the parties to the sale contract agree that the logs be sold ungraded.

**TABLE 6: DOMESTIC LOG GRADE SPECIFICATIONS**

LOG GRADE:	LOG SPECIFICATIONS:				
	<i>Small End Diameter</i>		<i>Max Knot</i>	<i>Lengths</i>	<i>Sweep Class*</i>
	<i>Min. (mm)</i>	<i>Max. (mm)</i>	<i>(mm)</i>	<i>(m)</i>	
<b>Pruned</b>					
P1	400	n/a	n/a	4.0 to 6.1	1
P2	300	399	n/a	4.0 to 6.1	1
<b>Unpruned</b>					
S1	400	n/a	60	4.0 to 6.1	1
S2	300	399	60	4.0 to 6.1	1
S3	200	299	60	4.0 to 6.1	1
L1	400	n/a	140	4.0 to 6.1	1
L2	300	399	140	4.0 to 6.1	1
L3	200	299	140	4.0 to 6.1	1
R	100	n/a	n/a	4.0 to 6.1	2
<b>MAXIMUM PERMISSIBLE SWEEP BY LENGTH CLASS</b>					
SWEEP CLASS:	LOG LENGTH (M):				
	< 3.7	3.7 - 4.8	4.9 - 7.6	> 7.6	
1	1/8 s.e.d.	1/4 s.e.d.	1/2 s.e.d.	1/2 s.e.d.	
2	s.e.d.	2 x s.e.d.	3 x s.e.d.	4 x s.e.d.	
Source: New Zealand Forest Research Institute, <i>Domestic Log Grades</i> , 1994.					

The typical log turnout from the average radiata pine tree which has been managed on a Direct Pruned Sawlog Regime is diagrammatised in Figure 10.

P1/P2 grades are normally used for plywood, veneer, or clearwood (knot-free) for fine finish, high-quality applications. S1/L1/S2/L2 grades are normally sawn into construction timber, or used for industrial situations such as in pallets and packaging. S3/L3 grades are small diameter logs and are predominantly used for industrial sawing. R grade is used for pulp, paper, and panel products.

### 3.1.1 Marketing Domestic Logs

Domestic logs are not traded in an organised market and do not flow through any particular point. The marketing of domestic logs usually involves direct negotiation between the buyer and seller without the association of any agents (except for the purposes of independent grading), and as such the flow of logs is usually by road (but

sometimes by rail) between the seller's and buyer's location. A truck load of logs equates to 28 - 30 m<sup>3</sup>.

**FIGURE 10: TYPICAL LOG TURNOUT  
(DIRECT PRUNED SAWLOG REGIME)**

Length of Section	Log Type	Log Grade	Recoverable Volume m <sup>3</sup>	Value
5m	Waste	-Waste	0.10	0.0 %
8m	Industrial Logs	-R	0.25	1.5 %
35m				
16.8m	Saw Logs	-S3/L3	0.35	
		-L1/L2	0.74	38.5 %
		-S1/S2	0.39	
5.2m	Pruned Logs	-P1/P2	0.58	60.0 %
<b>Total</b>			<u>2.41 m<sup>3</sup></u>	<u>100.0 %</u>

Source: New Zealand Forest Owners Association, *Forestry Facts and Figures*, 1994, p. 9, and Edger, *et al*, 1992, p. 34.

### **3.2 Export Logs**

The export log grading system also specifies homogeneous classes, but this system differs from the domestic grading system. Export logs are graded using scientific methods which suit consumer preferences and these reflect the customers local log grading system and measurement methods. Table 7 illustrates the specifications of the most common export grades. Some New Zealand log exporting companies use slight



variations to these specifications which reflect a superior product, price advantage, or concession.

**TABLE 7: EXPORT LOG GRADE SPECIFICATIONS**

LOG GRADE:		LOG SPECIFICATIONS:						
		<u>S.e.d. (mm)</u>		<u>L.e.d</u>	<u>Max Knot (mm)</u>	<u>Lengths (m)</u>	<u>Percentage Allowed</u>	<u>Sweep</u>
		<u>Min.</u>	<u>Ave.</u>	<u>Max.</u>				
Pruned								
Pruned peelers		300	n/a	n/a	n/a	4.0,6.0	Shipper's option	1/4 s.e.d.
Unpruned								
C&I construction peelers		300	n/a	n/a	80	4.0,6.0, 8.0	Shipper's option	1/4 s.e.d.
Korean peelers	H	160-200	260	n/a	70-80	4.0 6.0,8.0	5% max Shipper's option	1/4 s.e.d. 1/4 s.e.d.
Japan peelers	H	200	n/a	500	80	4.0,6.0, 8.0	Shipper's option	1/4 s.e.d.
Japan A		200	340	800	1/3 s.e.d up to 150 mm max. Excessive number of large knots not permitted.	4.0 8.0 12.0	10% max balance 50% min	1/4 s.e.d. 1/2 s.e.d. s.e.d.
Japan J		200	260	n/a	1/3 s.e.d. up to 150 mm max. Excessive number of large knots not permitted.	4.0 8.0 12.0	10% max balance 50% min	1/4 s.e.d. 1/2 s.e.d. s.e.d.
Korea K		200	260	n/a	1/3 s.e.d. up to 150 mm max. Excessive number of large knots not permitted.	3.6 5.4 7.3 11.0	balance 10% max balance 40% min	1/4 s.e.d. 1/4 s.e.d. 1/2 s.e.d. s.e.d.
China C		200	260	n/a	1/3 s.e.d. up to 150 mm max. Excessive number of large knots not permitted.	4.0 6.0,8.0, 10.0	15% max Shipper's option	1/4 s.e.d. 1/2 s.e.d.
Japan pulp		100	n/a	n/a	n/a	4.0,6.0, 8.0	Shipper's option	n/a

Source: Ministry of Forestry, "Marketing a Small Forest", Small Forest Management, Vol. 8, October 1994L.

Notes: An excessive number of knots means three or more whirls made up of 5 - 10 cm knots occurring in any 1 metre of a log

The typical log turnout of export grades is difficult to model, because different growing regimes can provide vastly different proportions of the various grades, and parts of the tree may be graded to one or more export categories. However, the typical log turnout scenario of a radiata pine tree managed on the common Intensive High Pruned Clearwood Regime is diagrammatised in Figure 11.

**FIGURE 11: TYPICAL EXPORT LOG TURNOUT**  
**(INTENSIVE HIGH PRUNED CLEARWOOD REGIME)**

Length of Section	Log Type	Log Grade	Recoverable Volume m <sup>3</sup>	Value
5m	Waste	-Waste	0.10	0.0 %
8m	Industrial Logs	-R	0.35	2.0 %
35m				
16.8m	Saw Logs	-Export A	0.72	22.2 %
		-Export K	0.23	4.3 %
		-S1/S2/S3 /L1/L2/L3	0.23	4.2 %
5.2m	Pruned Logs	-P1/P2	0.79	67.0 %
<b>Total</b>			<b>2.42 m<sup>3</sup></b>	<b>100.0 %</b>

Source: Ministry of Forestry, [Comment](#).

### 3.2.1 Marketing Export Logs

Export logs are not traded in an organised market either. However, all export logs flow through one of New Zealand's ports, and are normally handled by a log marshalling agent at the port of export. Log marshals provide a full range of services. Exporters can simply arrive at the marshal's wharf-side office, unload their logs, and leave the remainder of the organisation for export to the marshal. The marshal scientifically categories all logs using the grades detailed in Table 7 and places them in piles with logs of the same grade. The marshal then organises the loading of these piles

of logs of the same grade onto the ship when it arrives, and charges the exporter for these services. The purchaser normally buys the logs “sight unseen”.

Marketing of export logs normally takes longer than marketing domestic logs, but the handling of export logs at ports normally means that they are able to be kept cleaner and drier and, as a result, the logs normally last for up to six months without any deterioration.

### **3.2.2 Measurement Methods**

The Three Dimensional (3-D) Formula is used to measure the volume of domestic logs using cubic metres ( $\text{m}^3$ ). For export logs, Asian customers, although also using cubic metres, require that the Japanese Agricultural Standard (JAS) formula is used to measure the volume of logs (JAS  $\text{m}^3$ ).<sup>44</sup>

The 3-D formula is very accurate at computing the total volume of wood, but the formula is complex because three dimensions are involved. With the JAS formula, logs are segregated into fixed lengths and only the s.e.d is measured. Therefore only two dimensions are necessary (the length and s.e.d) and the measurement process is relatively simple.<sup>45</sup>

## **3.3 Timber**

Sawmills in New Zealand generally produce sawn timber to meet the specifications of the Standards Association of New Zealand’s “Timber Grading Rules”. NZS 3631:1988 “establishes visual grading rules for the selection of timber into quality classes”, which ultimately produces homogenous timber grades. The timber grades are specified within a system which provides for three main groups of log type, and four recognised grade categories. The system is presented in Table 8, but the standard should be consulted for the complete description of the specifications of each of these timber grades.

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44 Domestic logs are sometimes sold on the basis of weight, but export logs are almost always sold on the basis on JAS  $\text{m}^3$ .

45 The volume in the difference between the s.e.d and the l.e.d., multiplied by the length, is unmeasured.

If timber is exported it is usually sawn to specifications required by purchasers under their local grading system.

**TABLE 8: TIMBER CLASSIFICATION SYSTEM UNDER NZS 3631:1988**

<u>LOG GROUP:</u>	<u>GRADE CATEGORIES:</u>			
	<i>Appearance</i>	<i>Structural</i>	<i>Cuttings</i>	<i>Other</i>
Group I: Native Softwood	Clears Premium Dressing	Building	No. 1 Cuttings No. 2 Cuttings	Box
Group II: Hardwoods (Native, NZ grown exotic and imported)	Clears Premium Dressing	Engineering Building	No. 1 Cuttings No. 2 Cuttings	Box
Group III: Exotic Softwoods (NZ grown and imported)	Clears Select A Select B Dressing Merchantable	Engineering No. 1 Framing No. 2 Framing	No. 1 Cuttings No. 2 Cuttings	Box

Source: New Zealand Standards Association, *New Zealand Timber Grading Rules, NZS 3631:1988*, 1988, Table 1, p. 27

### 3.3.1 Marketing Timber

Neither domestic or export timber is traded in an organised market. The marketing of timber mirrors the methods used in the log markets. As with export grade logs, all export timber flows through one of New Zealand's ports, and is normally handled by a marshalling agent also, but domestic timber is normally marketed directly by the seller to a buyer.

A substantial proportion of timber is "treated" which allows it to be stored for long periods of time in suitable conditions. However, "untreated" timber will begin to rot, or deteriorate by warping and splitting, in just six months in normal outdoor storage conditions.

### 3.4 Conclusion

A tree, and hence forest, yields a composite of joint log products, not a single, homogeneous quality of log. The amount of each grade of log within a tree depends greatly on the timing of the harvest and the growing regime. With the acceptance of forestry audits, it may be possible to define a standard tree in terms of proportions of each log grade within a tree. However, this will not be for some time in the future as

forestry audits are only being developed at present, and as such no forests have yet been grown under this regime.

Trees, however, yield a composite of joint log products which may be scientifically categorised into homogeneous classes so that the logs can be traded on the basis of physical description — “sight unseen”. These may be graded under two different regimes: for export markets, or for the domestic market. Similarly, sawn timber may be scientifically graded under the Standards Association of New Zealand’s “Timber Grading Rules”, to produce homogeneous timber classes.

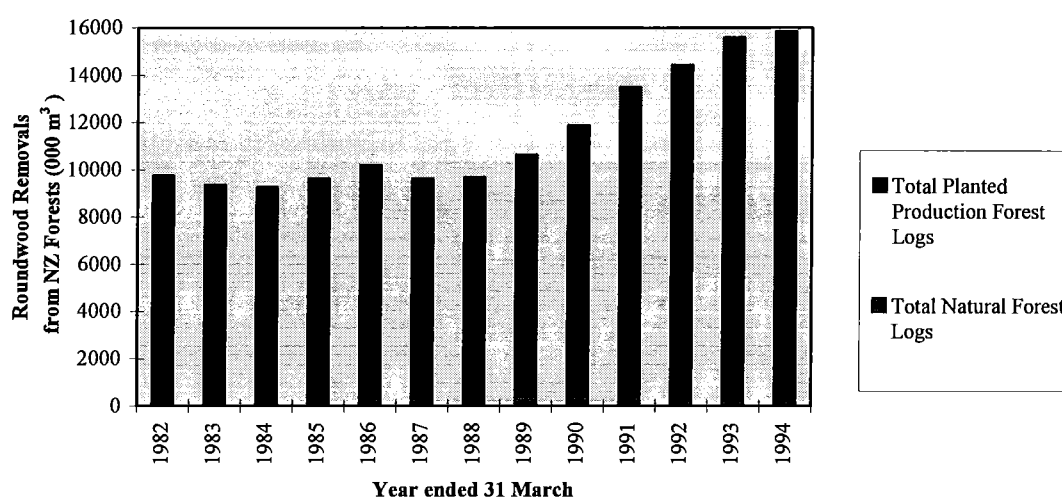
While the markets for logs and timber are not formalised, export grade logs and timber flow through a port, and a marshalling agent is usually used as part of the marketing method. Logs and timber can be stored, but not for significant time periods.

## **4. Supply Dynamics of Logs**

### **4.1 Present Supply**

New Zealand’s total log supply, termed “roundwood removals” or “log harvest”, for the year ended June 1994 was 15.838 million m<sup>3</sup>. Figure 12 shows the steady increase in the level of supply over the past 12 years, and the high proportion of removals from planted production forests.

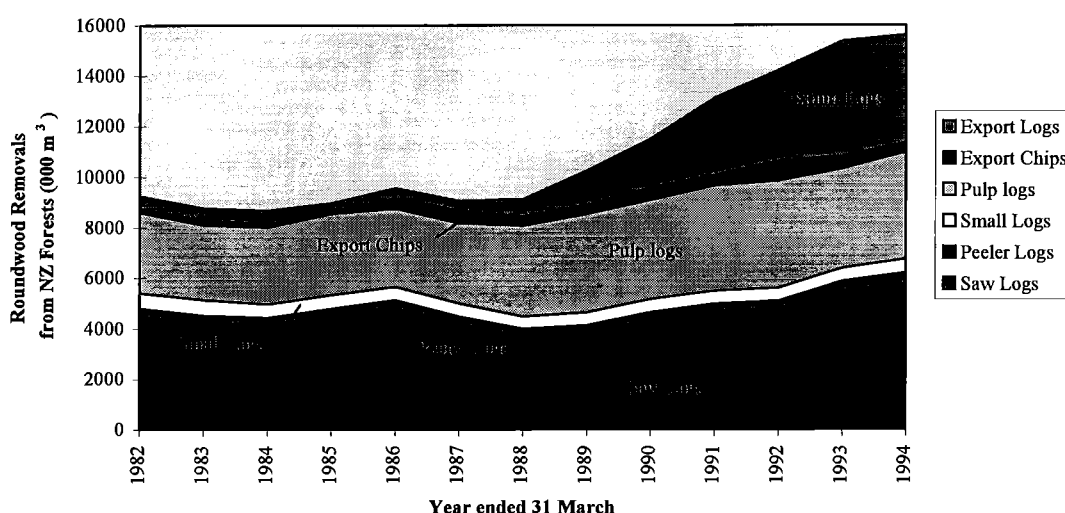
**FIGURE 12: ROUNDWOOD REMOVALS FROM NEW ZEALAND FORESTS**



Source: Ministry of Forestry, Statistical Release: Estimated Roundwood Removals from New Zealand Forests June 1994, 1994d.

Figure 13 classifies New Zealand's log harvest by log type to indicate the supply of the various types of forest removals. Three principal types, of approximately equal size, of log are supplied: export logs, pulp logs, and saw logs. This indicates that the planted production harvest is utilised in the export of unprocessed logs, the making of pulp which is ultimately transformed into paper and paperboard, and timber.

**FIGURE 13: HARVEST BY LOG TYPE**



Source: Ministry of Forestry, Statistical Release: Estimated Roundwood Removals from New Zealand Forests June 1994, 1994d.

Note: These figures are based on removals from planted production forests only.

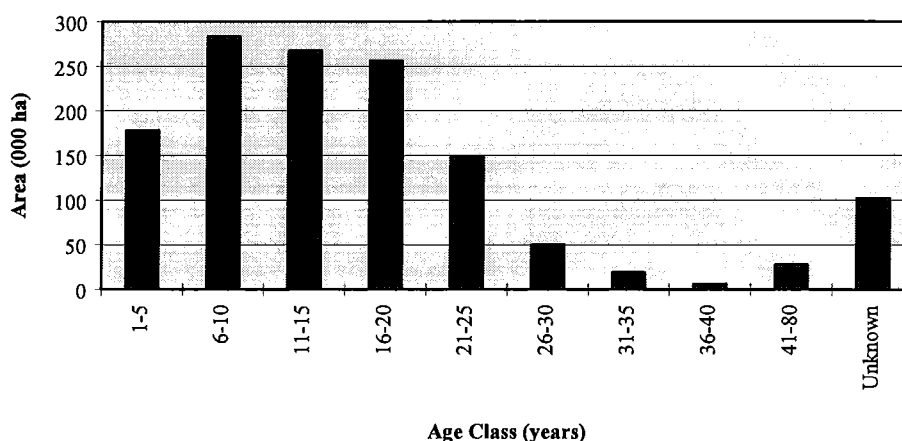
## 4.2 Future Supply

The supply of timber from New Zealand's planted production forests will increase in the future. First, this is because New Zealand's forestry resources are currently young, and as this resource matures a greater wood harvest will be possible. Second, there has been a significant amount of new planting over the past few years and the amount of new planting has recently increased. This increased level of new planting should be maintained in the future, and New Zealand has the available land to support increased planting. Finally, New Zealand has a competitive advantage in future production because of the rapid growth of radiata pine forests which leads to quick rotation.

### 4.2.1 Age Structure and New Planting

One of the most significant characteristics of New Zealand's planted production forests is the age structure which is presented in Figure 14. The forests are largely immature with approximately 58.9 % of the total stock aged 15 years or less, and 79.6 % aged 20 years or less.<sup>46</sup> As this young wood matures the annual available harvest is expected to rise to 19 million m<sup>3</sup> by the year 2000 and to 31 m<sup>3</sup> by 2010. (Ministry of Forestry, 1993a, p. 6).

**FIGURE 14: NET PRODUCTIVE RADIATA PINE FOREST AREA  
(BY AGE CLASS AS AT 1992)**



Source: Ministry of Forestry, *A National Exotic Forest Description*, 1 April 1993, Table 6, p. 23.

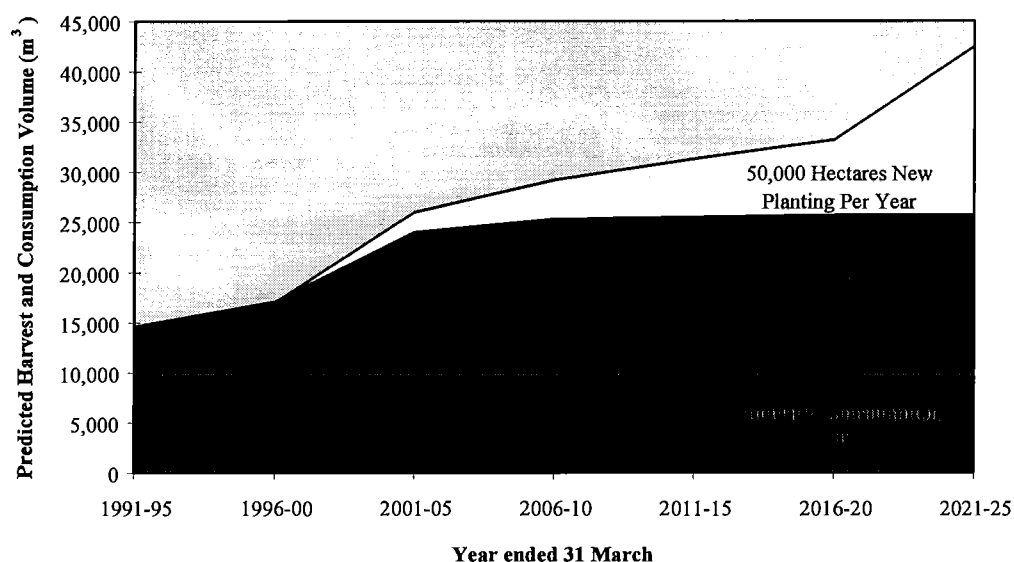
With additional afforestation, future wood availability will be even higher. With an additional 50,000 hectares of planting per annum, the available wood harvest could be as high as 40 million m<sup>3</sup> by the year 2020. As domestic consumption is not expected to rise materially, most of this additional harvest will be available for export in some form or another. This situation is graphically summarised in Figure 15.

The longer term predictions of Figure 15 are based on new planting presumptions. As Figure 16 shows, there has been a significant amount of new planting over the past few years and the amount of new planting has recently increased. New land planting

<sup>46</sup> These percentages are based on the areas for which the age is known.

reached 48,000 hectares in 1992 (provisionally) and is estimated at 61,000 hectares for 1993.

**FIGURE 15: NEW ZEALAND'S PREDICTED HARVEST AND CURRENT INDUSTRIAL CONSUMPTION**

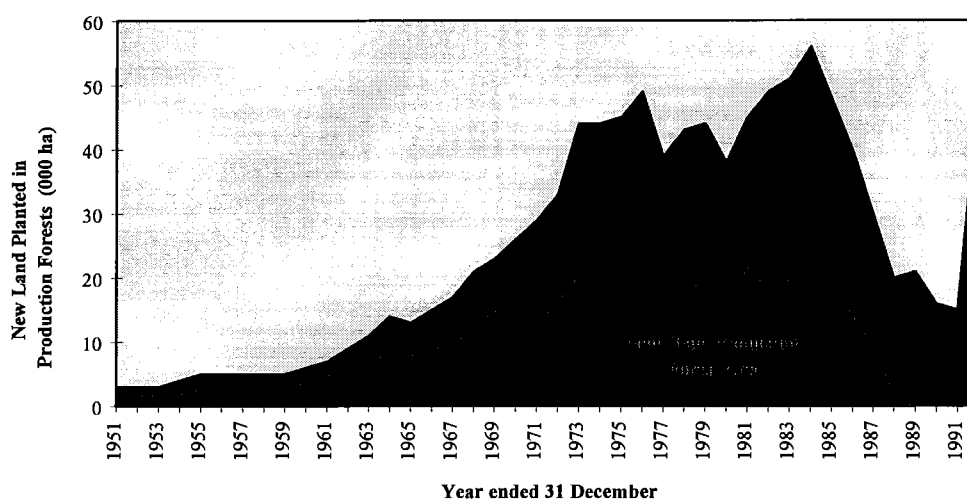


Source: Ministry of Forestry, *Investment Opportunities in the New Zealand Forest Industry*, 1994, p. 16

Note: The harvest projections are derived by the Ministry of Forestry and the draft NEFD 1992 Woodflow Predictions, and are consequently dependent on the assumptions of those predictions.

These levels are likely to be maintained, as the factors which have contributed to the recent increase in planting levels are likely to continue. Currently, the private sector is totally responsible for new planting and a large proportion is by smaller landowners, often as superannuation schemes and through joint ventures. The Forest Owners Association guesstimates that 70 % of recent new planting has been done by small scale operators. The factors, many of which have previously been stated, that have contributed to increased interest in forestry investment include superannuation changes and timber price forecasts. Evidence of rekindled interest is provided by Figure 16 which shows a dramatic rise in New Zealand's total planted production area, and Figure 17 which shows a dramatic increase in planting (over and above reforestation) by the private sector.

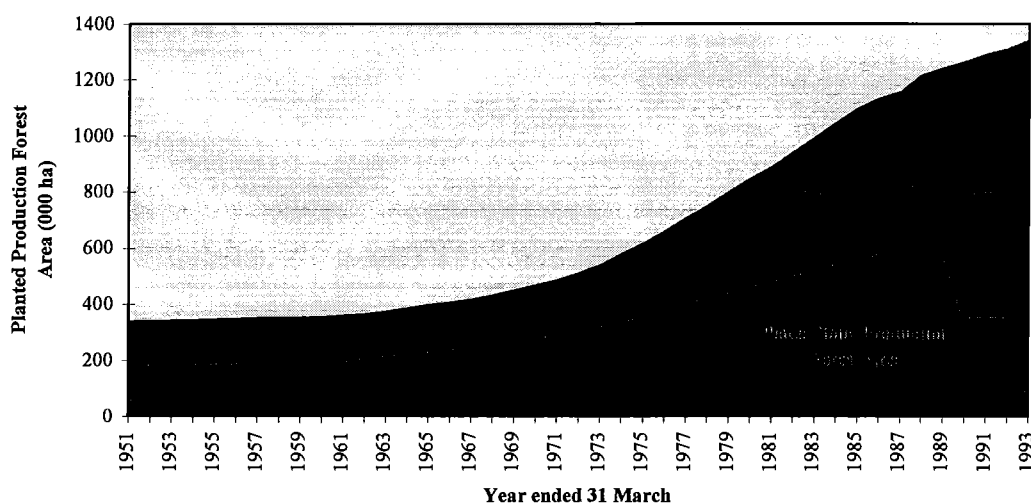


**FIGURE 16: NEW LAND PLANTED IN PRODUCTION FORESTS IN NEW ZEALAND**

Source: Ministry of Forestry, *Statistical Release: New Zealand Planted Production Forests*, 1993, Table 3.

Note:

1. The sources for these statistics have changed through time. Until 1987 the statistics were compiled by the New Zealand Forest Service. The figures since then are estimates from NEFD and Ministry of Forestry surveys.
2. Private new planting figures are based on incomplete historical data, and considerable estimation has taken place.
3. From 1989 no distinction is made between private and state planting, and all new planting is categorised as private planting although some private companies are state owned.

**FIGURE 17: PLANTED PRODUCTION FOREST AREA IN NEW ZEALAND**

Source: Ministry of Forestry, *Statistical Release: New Zealand Planted Production Forests*, 1993, Table 4.

Note:

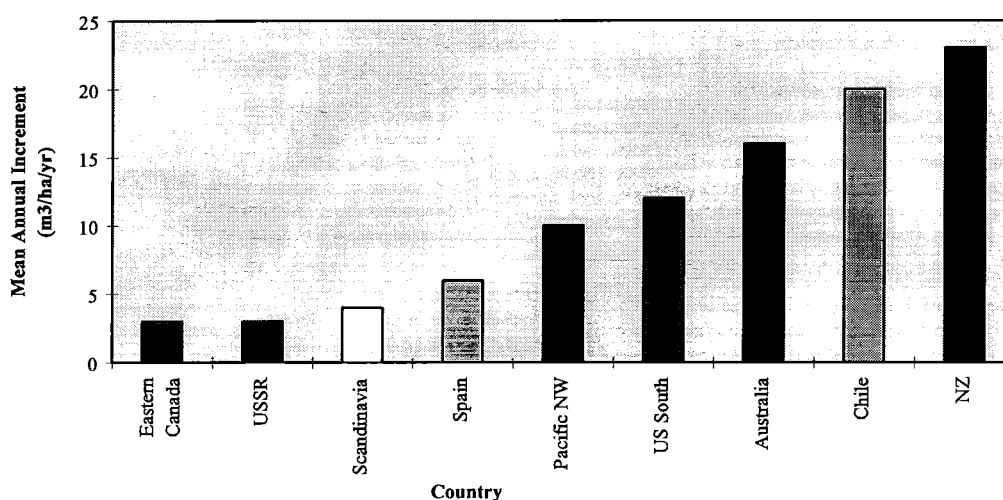
1. The sources for these statistics have changed through time. Until 1987 the statistics were compiled by the New Zealand Forest Service. The figures since then are estimates from NEFD surveys.
2. Between 1989 and 1990 249,000 hectares of state forests were sold. During 1992 an additional 97,000 hectares were sold.
3. Private afforestation figures are based on incomplete historical data, and considerable estimation has taken place.

It has been estimated that New Zealand has a further three to five million hectares of land more economically suited to forestry, and therefore these increased levels of planting could be maintained for at least another 60 years.

#### 4.2.2 Growth Rate

A major component of the competitive advantage of New Zealand's forestry industry is the rapid growth and quick rotation of radiata pine forests. Radiata pine has a growth rate of 20 to 25 m<sup>3</sup> per hectare per year. This makes it one of the fastest growing commercially traded softwood species in the world. This is shown in Figure 18 which compares the average growth rates of softwood from producers around the world. As a result of this rapid growth, radiata pine forests are ready to harvest in 25 to 30 years, which compares very favourably with Northern Hemisphere temperate softwood forests which require 50 to 150 years to mature (Ministry of Forestry, 1992a, p. 5).

**FIGURE 18: INTERNATIONAL COMPARISON OF SOFTWOOD GROWTH RATES**



Source: Ministry of Forestry, *Forestry — Investment Opportunities in the New Zealand Forest Industry*, 1992b, p. 7.

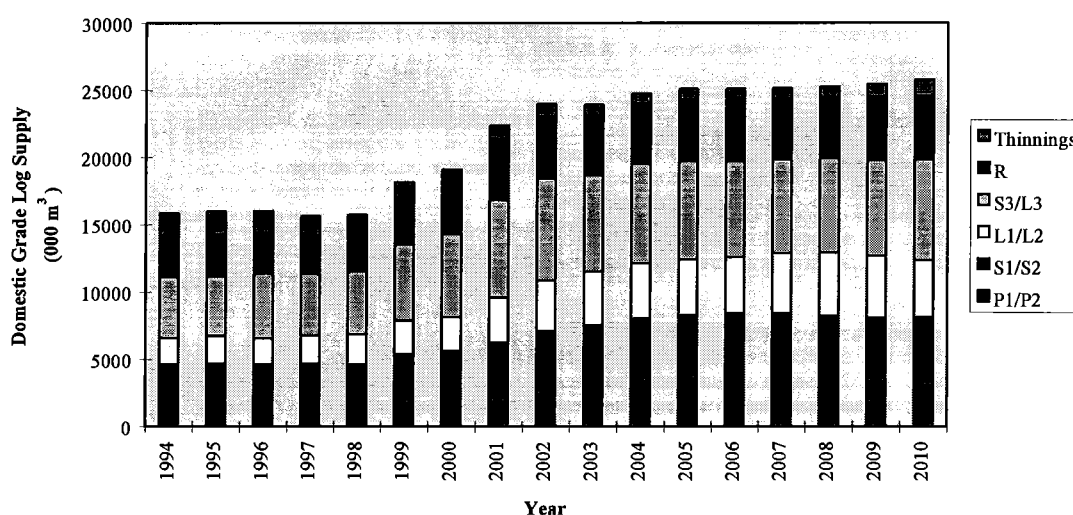
Rapid growth and quick rotation provides a number of commercial advantages (Ministry of Forestry, 1993b, p. 6):

- It enables the forest industry to capture genetic improvements more quickly than competitors.
- It provides significantly better financial returns.
- Smaller land areas can support sustainable forests.

### 4.2.3 Supply of Domestic Grade Logs

In 1992, the Ministry of Forestry forecasted New Zealand's future wood supply.<sup>47</sup> Figure 19 illustrates these predictions, and reflects the pattern shown in Figure 15 that the total harvest will increase substantially in the future. Figure 19 identifies that the supply of all grades will increase in the future. This is especially true of saw logs which are normally able to be exported if they meet international requirements. The figure also shows that the recoverable volume from thinning will decrease in the future. This reflects the likely increase in management effectiveness, in that new techniques are continuing to develop which ultimately produce logs of greater value.

**FIGURE 19: FORECAST OF DOMESTIC GRADE LOGS**



Source: Ministry of Forestry, *Wood Supply to Independent Processors in New Zealand*, Ministry of Forestry, Wellington, March 1993c, pp. 28-34.

### 4.3 Global Forest Estate

The world has a total of 2,800 million hectares of natural and man-made forests, which represents 20 % of the land area. 70 % of these forests are productive, and the

47 The woodflow predictions assumed a base case requiring that:

- a target rotation age of 30 years be used for radiata pine,
- all harvested areas are restocked the year following harvesting,
- there is no new planting,
- the yield from radiata pine does not decrease per hectare at any time in the future.

balance is principally classified as unproductive, primarily because of access difficulties and environmental reasons. 60 % of global forests are hardwood, and 40 % softwood. As shown in Figure 20, radiata pine (which is a softwood) has a global plantation area of 3.69 million hectares of which 34 % or 1.25 million hectares are growing in New Zealand (Facts and Figures, 1994, and Edger, 1992, pp. 1-4).

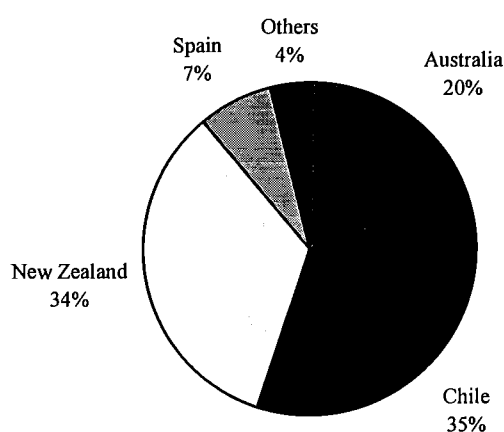
The annual global harvest of all timber exceeds 3.4 billion m<sup>3</sup> per year; approximately half of the harvest is utilised in industry, and the balance is used for fuel wood (primarily in under developed countries). Proportionately more softwood is used in industry, and proportionately more hardwood is used for fuel (Facts and Figures, 1994, and Edger, 1992, pp. 1-4).

As shown, New Zealand's annual roundwood removals, which equates to annual harvest, for the June 1994 year was 15.886 million m<sup>3</sup>. New Zealand's harvest, which is mostly used in industry, therefore accounts for less than 1 % of the world's industrial harvest.

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**FIGURE 20: PERCENTAGE HOLDING OF GLOBAL RADIATA BY COUNTRY**  
**(1993)**  
**(EST. TOTAL RADIATA AREA 3.69 M HA)**

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Source: New Zealand Forest Owners Association Inc, *Forestry Facts and Figures 1994*, 1994, p. 1.

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World demand is presently increasing (as is shown later), but at the same time world supply is becoming increasingly restricted. Depletion of easily assessable "old growth" softwood and tropical hardwood forests and environmental pressure for

conservation is reducing future supply options. This diminishing yield is predicted to impact severely on traditional supply regions.

It has been predicted that North America will not continue to be *self-sustaining* in wood production as supplies of “old growth” timber are being depleted and increasing environmental concerns regarding ecological diversity and endangered species (such as the Spotted Owl) result in substantial reductions in local timber harvest. Under a recently announced Presidential Plan, logging in US Federal forests will be reduced to an average of 1.2 billion board feet (2.8 million m<sup>3</sup>) p.a. This compares with an average annual harvest between 1986 and 1989 of 5.6 billion board feet (13.2 million m<sup>3</sup>) p.a.

Reduced levels of hardwood logging in Southeast Asia, as a result of unsustainability concerns, are also having an effect on production. Both the Sarawak and Sabah Governments have legislated log bans which commit them to reducing log harvests in line with the recommendations of the International Tropical Timber Organisation. By the year 2000, this organisation aims to have all traded tropical timber originating only from forests which are managed on a sustainable basis. Currently, these two states export 17.6 million m<sup>3</sup> p.a.

The annual harvest of forests within Europe and the Commonwealth of Independent States is substantially less than the incremental growth, and this area contains more than half the world's coniferous forests. Obviously these forests are a large untapped supply. However, much of this area is unharvestable, with areas difficult to access, because of environmental concern, and for institutional and economic reasons. Further, Russia has recently removed subsidies to the forestry industry which has lowered the economic viability of harvesting much of this area.<sup>48</sup>

#### **4.4 New Zealand's Supply to the Pacific Asia Region**

The biggest world market for softwood logs is Pacific Asia. Because the annual log harvest of this region is predicted to contract by up to 50 million m<sup>3</sup> by 1995, and because of the rapidly increasing populations and growing economies of the region, there will be a significant supply shortfall in Asia Pacific in the future. The largest

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<sup>48</sup> The subsidies have been necessary because much of this area has significant frost related problems which increases the costs of harvesting and replanting.

shortfall will be in China, but supply shortfalls are also likely in Japan, Indonesia, India, South Korea and Malaysia.

As will be shown later, Pacific Asia absorbs the majority of New Zealand's exports. This is principally because New Zealand is blessed with excellent proximity to this market.

While New Zealand's supply is insignificant in global terms, it is of significance in Pacific Asia. As this country's log harvest increases in the future New Zealand's significance will increase dramatically. New Zealand currently provides 3.9 % of the total industrial roundwood supply to Pacific Asia, but after the increase in sustainable yield to 25 million m<sup>3</sup> over the next fifteen years, this is predicted to increase to 8.5 % (Ministry of Forestry, 1992b).

#### **4.5 Summary**

New Zealand's present log supply (for the year ended June 1994) is 15.838 million m<sup>3</sup>. Of approximately equal proportions, this harvest is demanded in raw form by the export market, the pulp and paper industry, and the sawmilling industry.

The supply of timber from New Zealand's planted production forests will increase in the future. Firstly, this is because the resources are currently young, and as this resource matures a greater wood harvest will be possible. Second, there has been a significant amount of new planting over the past few years and the amount of new planting has recently increased. This increased level of new planting should continue in the future, and New Zealand has the available land to support this level of planting. Finally, New Zealand has a competitive advantage in future production because of the rapid growth of radiata pine forests which leads to quick rotation. Ministry of Forestry forecasts support this conclusion, and estimate that with additional afforestation of 50,000 hectares per annum, the available wood harvest could be as high as 40 million m<sup>3</sup> by the year 2020.

20 % of the world's land area is covered with 2,800 million hectares of natural and man-made forests. 40 % (or 1,120) of the global forests are softwood. Radiata pine makes up just over 3 % of the global softwood forests, and a third of this resource is in New Zealand. As a result, New Zealand contributes to the global harvest less than 1 %.

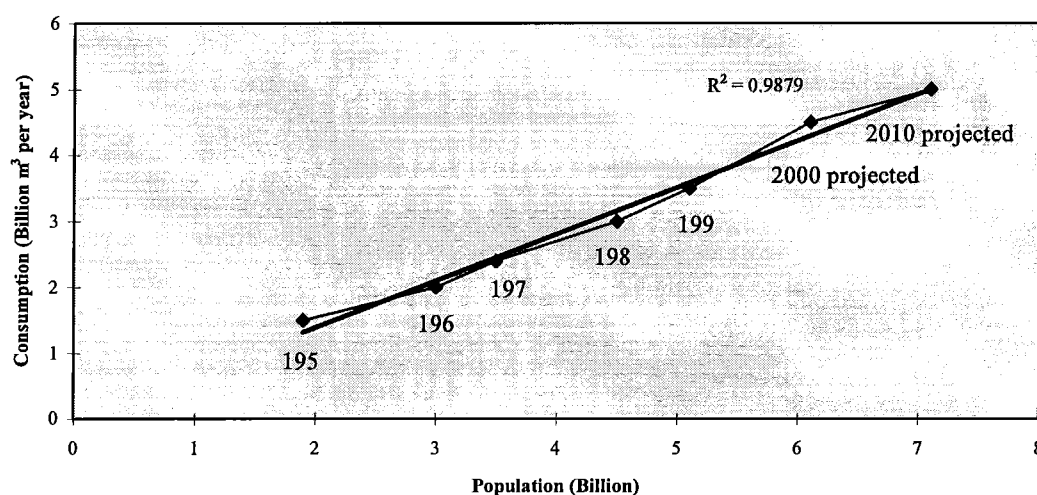
However, although New Zealand's contribution to the world's industrial harvest is small, its contribution will become increasingly important. This is because large proportions of the easily assessable "old growth" forests, and environmental pressures, are reducing the supply from forest areas which are not self-sustaining. New Zealand's planted production forests are, however, all managed on a sustainable yield so the supply can be maintained.

Although New Zealand's output is insignificant in global terms, it is of significance in Asia Pacific, because of excellent proximity to this market. After an increase in sustainable yield to 25 million m<sup>3</sup> which is predicted to occur over the next fifteen years, New Zealand's market share will increase to 8.5 %.

## **5. Demand Dynamics of Logs**

### **5.1 World Demand**

**FIGURE 21: CORRELATION BETWEEN TOTAL WORLD WOOD HARVEST  
AND WORLD POPULATION**



Source: FOA, 1993.

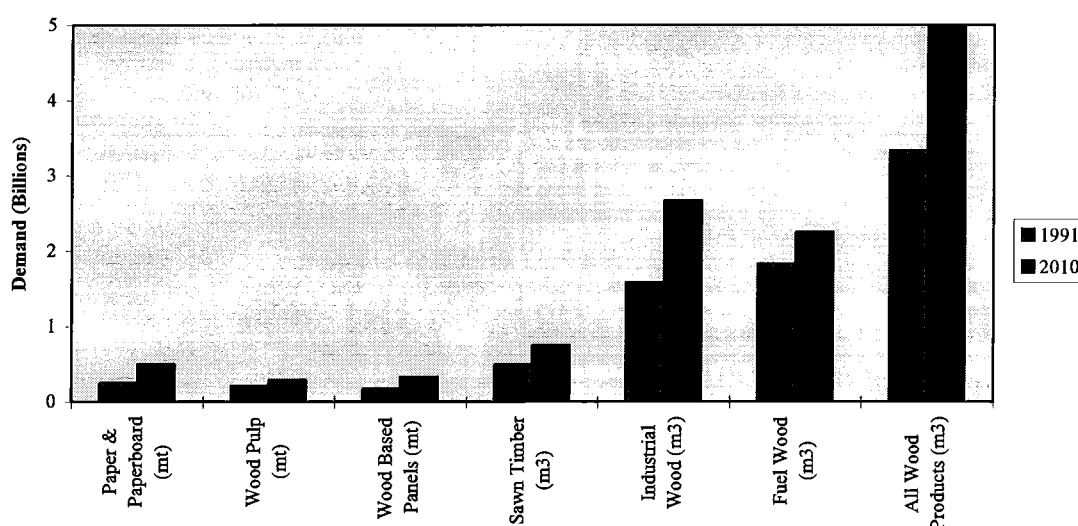
Note:

- (1) The Correlation Coefficient is explained in the next section, and it is not necessary to consider the derivation and meaning of the statistic in this section. The high level of correlation can be seen in the graph.
- (2) The data points for the years 2000 and 2010 are projected.

Historically, world consumption of wood has been increasing with population growth, and improving living standards. The United Nations Food and Agricultural Organisation (FAO) predicts that world roundwood consumption will increase by more than 40 %, from the current 3.4 billion m<sup>3</sup> per year to 5 billion m<sup>3</sup> per year by 2010. This is driven by a world population increase of 37 %, and a 7 % increase in per capita wood consumption over the same period. Figure 21 provides graphical evidence of the correlation between the world wide consumption of wood and population growth.

Using estimation techniques, the FAO have forecasted the future demand for some categories of forest products. Figure 22 shows this future demand, and compares this with the level of consumption in 1991.

**FIGURE 22: GLOBAL WOOD AND FORESTS PRODUCTS DEMAND**



Source: FOA, 1993.

## **5.2 New Zealand's Forestry Production and Exports**

The demand for New Zealand's log harvest is driven by export and domestic markets. The total value of New Zealand's forestry products exported for the year ended 30 June 1994 was NZ\$ 2.468 billion (Ministry of Forestry, 1994f). The total value of all New Zealand's merchandise exports (excluding re-exports) for the year ended 30 June 1994 was \$NZ 19.150 billion (Ibid). Exports of forestry products therefore accounted for 12.9 % of New Zealand's total exports in the June 1994 year,



and this makes the industry the country's third largest export earner. The sector accounts for 6 % of our gross domestic product (Ministry of Forestry, 1993a).

Currently, an estimated 64 %, or the equivalent of 10 million m<sup>3</sup>, of total roundwood removals is ultimately exported in some form. By volume, the largest proportion of roundwood equivalent exports is unprocessed logs, which accounts for 38 % of total roundwood equivalent exports. These logs have a value of \$NZ 781 million. The remainder of the log harvest is further processed in established New Zealand industries to produce a narrow product mix of just three main commodity groups:

- Sawn Timber.
- Pulp.
- Paper and Paperboard.

Currently, 2,763,000 m<sup>3</sup> of sawn timber is produced, and 938,000 m<sup>3</sup> (or 34 %) is exported. The timber exported has a value of \$NZ 512 million, and is equivalent to 2,064,000 m<sup>3</sup> of roundwood. 1,359,080 tonnes of pulp is produced, and 628,928 tonnes (or 46 %) is exported. The pulp exported has a value of \$NZ 327 million, and is equivalent to 2,346,000 m<sup>3</sup> of roundwood. 841,165 tonnes of paper and paperboard is produced, and 368,773 tonnes (44 %) is exported. The paper and paperboard exported has a value of \$NZ 327 million and is equivalent to 1,356,000 m<sup>3</sup> of roundwood. These figures are drawn from Table 9.

**TABLE 9: PRODUCTION AND EXPORTS OF SELECTED FORESTRY PRODUCTS**  
(YEAR ENDED 30 JUNE 1994)

	PRODUCTION:*	EXPORTS:**			
	<i>Total</i>	<i>Quantity Directly Exported</i>	<i>000 m<sup>3</sup> of Roundwood equivalent</i>	<i>% of Production Exported</i>	<i>N Z \$000 of Value (at Mill f.o.b.)<sup>2</sup></i>
Logs	15,838,000 m <sup>3</sup>	4,313,000 m <sup>3</sup>	4,313	27.23	781,013
Timber	2,763,000 m <sup>3</sup>	938,000 m <sup>3</sup>	2,064	33.95	512,078
Pulp	1,359,080 ts	628,928 ts	2,346	46.28	326,977
Paper and Paperboard	841,165 ts	368,773 ts	1,356	43.84	327,054
Other Forestry Products	<sup>3</sup> 572,784 m <sup>3</sup>	n/a	1,302	n/a	520,656
Total	n/a <sup>4</sup>	n/a	10,060 <sup>5</sup>	63.52 % <sup>6</sup>	2,467,777 <sup>7</sup>

Sources:

\* "Production", is sourced from Forestry Statistics Section, Ministry of Forestry, Statistical Release: Estimated Roundwood Removals from New Zealand Forests; Statistical Release: Production and Stocks of Sawn Timber; Statistical Release: Production and Stocks of Pulp, Paper and Paperboard; Statistical Release: Production and Stocks of Veneer, Plywood, Particleboard & Fibreboard; all dated, June 1994, and the INFOS database, Statistics New Zealand using the following series identifiers:

Total Timber Production — FLTq.SBEA3  
Total Pulp — FLTg.SPFA  
Total Paper and Paperboard — FLTg.SPGA  
Other Forestry Products — Plywood — FLTq.SMAA  
— Particleboard — FLTq.SMBA  
— Fibreboard — FLTa.SMDA

\*\* *"Quantity directly exported", "Roundwood equivalent" and "Value"* are sourced from Ministry of Forestry, Statistical Release: Exports of Forestry Products, June 1994, p. 3, Table 1, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Total Logs — 4403.10.0001, 4403.10.0009, 4403.10.0019, 4403.10.0021, 4403.10.0029, 4403.20.0001, 4403.20.0009, 4403.20.0011, 4403.20.0019 and 4403.99.0000.

Total Timber Production — 4407.10, 4407.21, 4407.22, 4407.23, 4407.91, 4407.92, 4407.99.

Total Pulp — 47.

Total Paper and Paperboard — FLTg.SPGA.

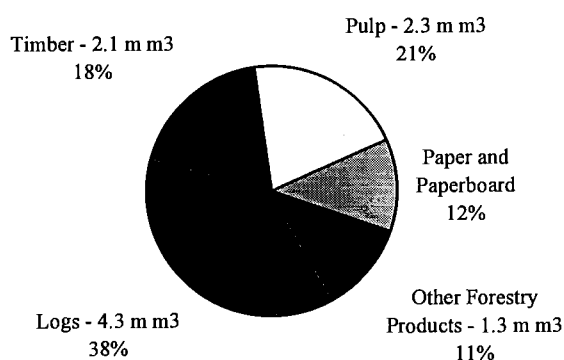
Other Forestry Products — Plywood — 4408, 4412.  
— Particleboard — 4410.  
— Fibreboard — 4411

**Notes:**

- (1) Roundwood equivalent has been estimated by the Ministry of Forestry using recognised conversion factors.
- (2) Items are NZ\$ free on board (f.o.b.) and may include items for which no quantities are given.
- (3) This sub-total does not include those Other Forestry Products which are not measured in m<sup>3</sup>, for example, woodchips, and value added products such as wooden furniture parts.
- (4) It is not appropriate to sum the sub-totals of this column because the units of measure of the various sub-totals are different; and more importantly, because the total would be meaningless since some timber is an output from one category and an input to another (for example, the input for all categories is the first category, logs).
- (5) This figure is not the sum of the sub-totals, because some timber residue is used as inputs for other products.
- (6) This total is not the sum of the sub-totals, but the total of export roundwood equivalent as a percentage of total roundwood removed (i.e.  $10,060/15,838 = 63.52\%$ ).
- (7) This is the sum total value of all forestry export receipts for the year ended 30 June 1994, and this value represents 12.89 % of total merchandise export revenues.
- (8) All figures are derived from quarterly data, and as the fourth quarter of that data was only provisional, the entire data set is provisional. However, because historically changes have been of very insignificant amounts, any change is likely to be immaterial.

The proportion of each of these export product categories to total forestry exports by roundwood equivalent and by value, is shown in Figure 23 & Figure 24 respectively. The largest proportion of roundwood equivalent exports is unprocessed logs, which accounts for 38 % of total forestry exports. By value, logs account for 32 %. The second largest proportion of exports by roundwood equivalent is pulp, which accounts for 21 % of total exports. However, by value pulp ranks third and accounts for only 13 % of exports. The third largest proportion of roundwood equivalent exports is timber, which accounts for 18 % of total exports. By value, however, timber is the second largest category and accounts for 21 %. Paper and paperboard only accounts for 12 % by roundwood equivalent, and 13 % by value. The other category consists of a large number of products including fibreboard, plywood, veneer, particleboard, wooden furniture, etc.

**FIGURE 23: EXPORTS OF FORESTRY PRODUCTS BY ROUNDWOOD EQUIVALENT**  
**(YEAR ENDED 30 JUNE 1994 (PROVISIONAL))**  
**(TOTAL ROUNDWOOD EQUIVALENT 10.060 BILLION M<sup>3</sup>)**

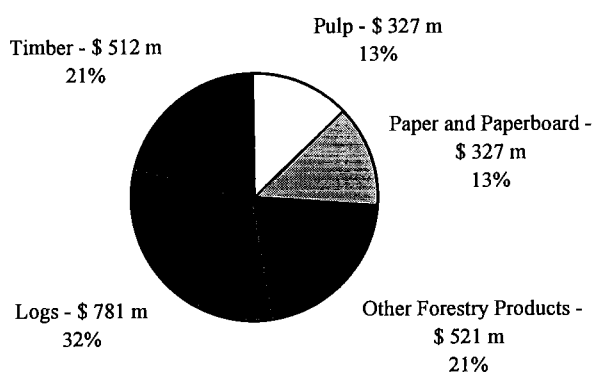


Source: Table 9: Production and Exports of Selected Forestry Products

Note: *Other Forestry Products* includes; Wood chips, Fibreboard, Plywood, Veneer, Particleboard etc.

Clearly, because the processing industries add value to the raw product (logs), value added products have a higher proportion of the total exports by value than by roundwood equivalent.

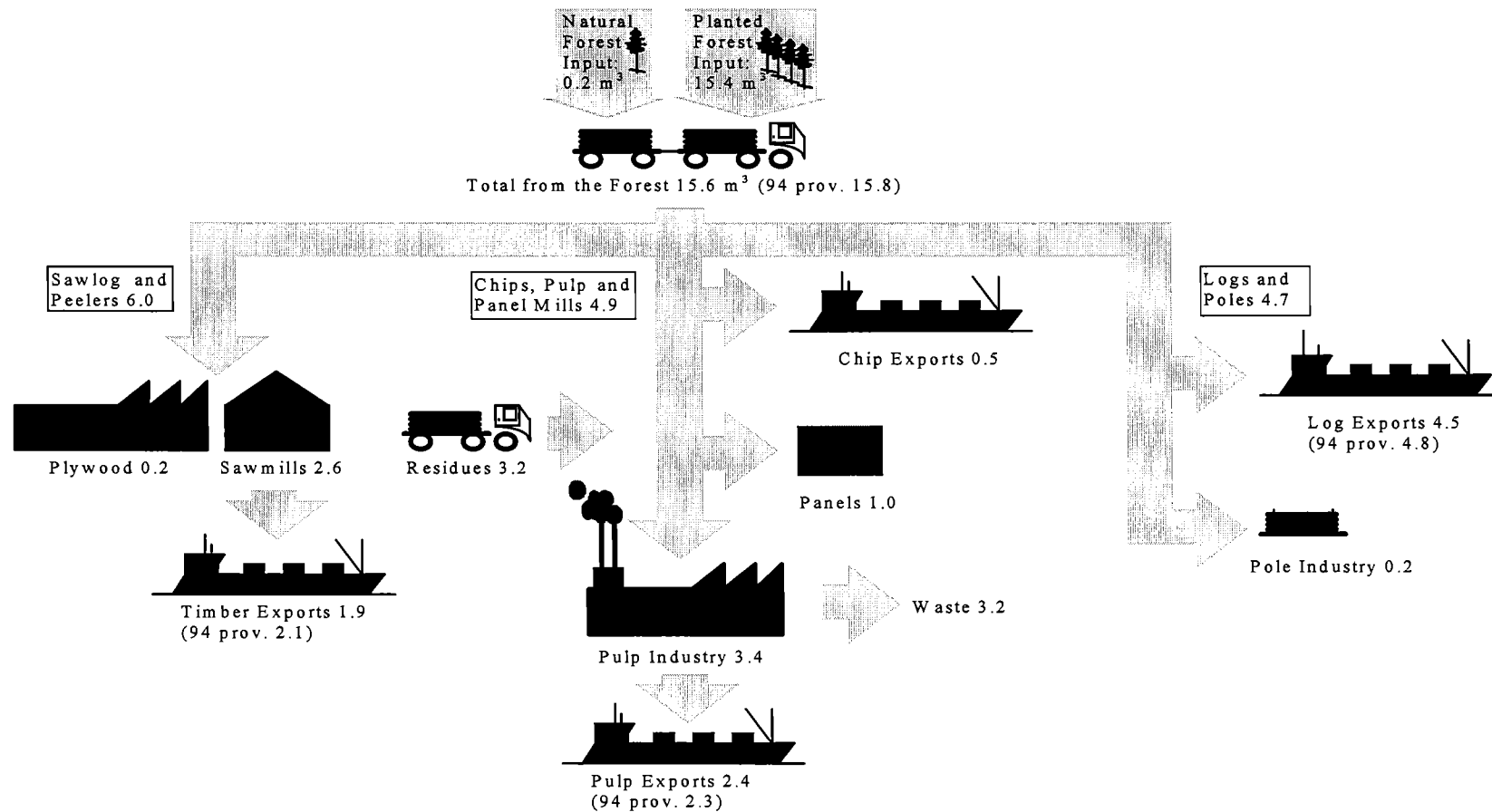
**FIGURE 24: EXPORTS OF FORESTRY PRODUCTS BY VALUE**  
**(YEAR ENDED 30 JUNE 1994 (PROVISIONAL))**  
**(TOTAL EXPORT RECEIPTS \$ 2.468 BILLION)**



Source: Table 9: Production and Exports of Selected Forestry Products.

Figure 25 shows the flow of timber within these industries.

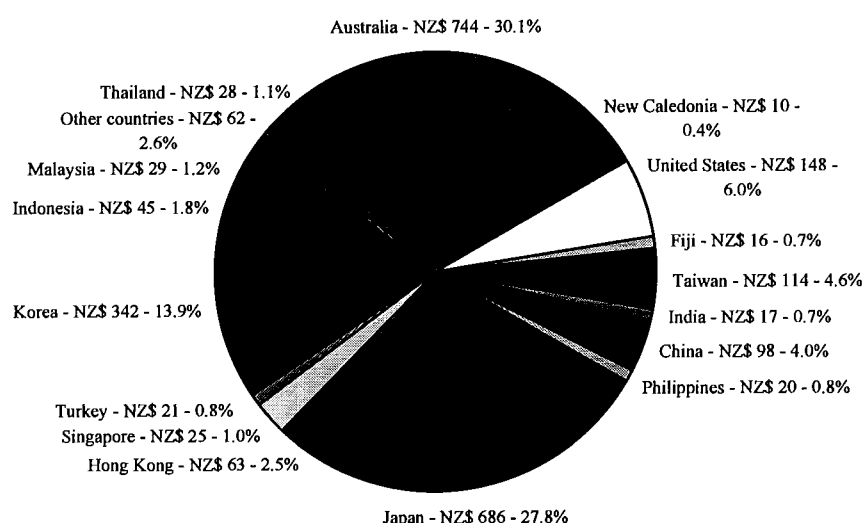
**FIGURE 25: LOG FLOW IN THE NZ FOREST INDUSTRY**  
**(VOLUMES IN MILLIONS OF m<sup>3</sup> OF ROUNDWOOD EQUIVALENT AS AT 31 MARCH 1993, AND PROVISIONAL 1994 DATA)**



New Zealand's forestry exports by volume of wood and value have nearly doubled over the last four years. This growth reflects both an increase in market opportunities and the increasing wood harvest. Further growth should continue as these forces still exist in New Zealand (Ministry of Forestry, 1993a).

The projected rise in wood supply from planted production forests in New Zealand (and the increased demand from international markets) could result in the industry returning more than \$NZ 4 billion per annum by the year 2000 (Ministry of Forestry, 1993a).<sup>49</sup>

**FIGURE 26: EXPORT DESTINATIONS**  
(YEAR ENDED 30 JUNE 1994 (PROVISIONAL))  
(TOTAL EXPORT RECEIPTS \$ 2.468 BILLION)



Source: Ministry of Forestry, Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f.

49 Two important developments will also have an important affect on the world trade of forest products, and hence the future earnings of the industry. Firstly, the Uruguay Round of the GATT negotiations will provide improved international trade in general because of reduced tariffs on forestry products. Many markets of several products will have zero tariffs, and the large market in Japan will have reduced tariffs on panel products although they have maintained tariffs on timber (Ministry of Foreign Affairs and Trade, 1994, pp. 47-49). Second, recent years have also seen a number of global environmental agreements signed at the Earth Summit. These include the Forestry Principles, which comprise a set of guiding principles on the management of all forests. The International Tropical Timber Agreement also emphasises conservation and sustainable management goals for tropical forests.

New Zealand is well placed to benefit from both these developments. Lower tariffs improve access to international markets, and New Zealand's early move to sustainable forestry resources, places this country in an excellent competitive position since the rest of the world is yet to make this transition.

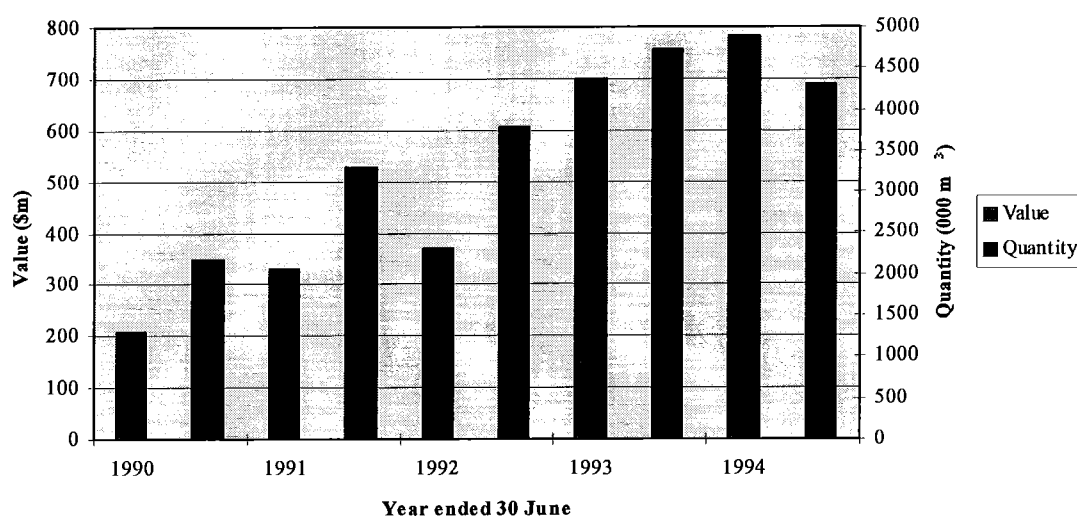
Not only is the product mix relatively narrow, but just three countries, Australia, Japan, and Korea, purchase 72 % of total forestry exports. This is shown in Figure 26.

### 5.2.1 Log Exports

The supply of logs is presented in Figure 12 which in technical terms shows the total log harvest or roundwood removals. Figure 13 presents the harvest by log type. These graphs show that the log harvest is increasing, and that the majority of this additional harvest is being exported or manufactured into sawn timber.

For the year ended 30 June 1994, 4,313,000 m<sup>3</sup> of the total log harvest of 15,838,000 m<sup>3</sup> was exported directly. This represents 27 % of the log harvest, and 38 % of the total exports by roundwood equivalent. Figure 27 shows that both the value and quantity of these log exports has been increasing since 1990.

**FIGURE 27: THE VALUE AND QUANTITY OF LOGS EXPORTED**



Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Total Logs — 4403.10.0001, 4403.10.0009, 4403.10.0019, 4403.10.0021, 4403.10.0029, 4403.20.0001, 4403.20.0009, 4403.20.0011, 4403.20.0019 and 4403.99.0000.

Note: Items are NZ\$ free on board (f.o.b.) and may include items for which no quantities are given.

Figure 28 reveals that Korea and Japan purchase the large majority of log exports by quantity<sup>50</sup> acquiring 45 % and 38 % respectively. China is the third largest purchaser

<sup>50</sup> The same situation is evident if log values are used, except that Japan takes a slightly greater proportion because they purchase higher value logs than Korea.

buying just 9 %. A large number of other countries purchase the remaining 8 %. This close link to Pacific Asia is also reflected in exports of other products.

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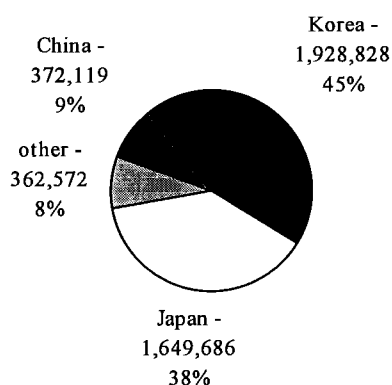
**FIGURE 28: LOG EXPORTS BY QUANTITY TO EACH COUNTRY**

(YEAR ENDED 30 JUNE 1994)

(TOTAL LOG EXPORTS 4,313,205 m<sup>3</sup>)

(M<sup>3</sup>)

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Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994*, 1994f, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Total Logs — 4403.10.0001, 4403.10.0009, 4403.10.0019, 4403.10.0021, 4403.10.0029, 4403.20.0001, 4403.20.0009, 4403.20.0011, 4403.20.0019 and 4403.99.0000.

Note: The source for this table has aggregated the poles with logs.

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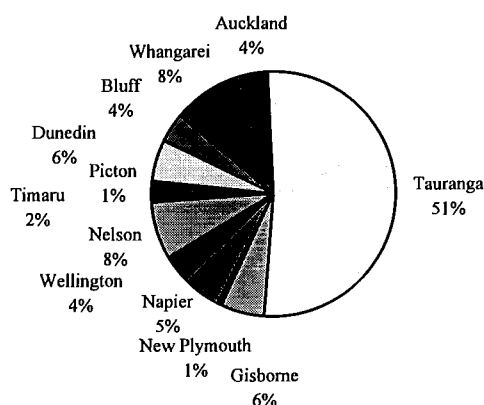


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**FIGURE 29: LOG EXPORTS SHIPPED FROM EACH PORT BY QUANTITY**

(YEAR ENDED SEPTEMBER 1994 (PROVISIONAL))

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Source: Ministry of Forestry, *Statistical Release: Exports of Logs and Wood Chips by Port September 1994*, 1994c, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Total Logs — 4403.10.0001, 4403.10.0009, 4403.10.0019, 4403.10.0021, 4403.10.0029, 4403.20.0001, 4403.20.0009, 4403.20.0011, 4403.20.0019 and 4403.99.0000.

Note: The source for this table has aggregated the poles with logs.

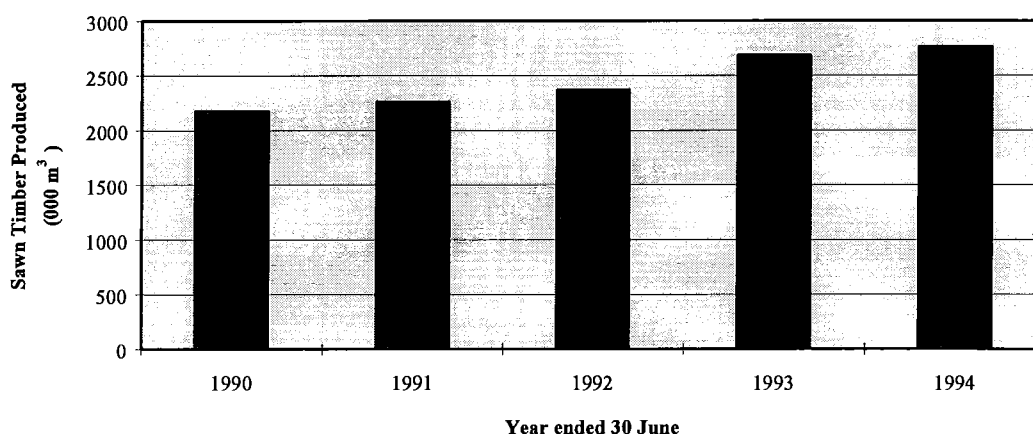
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As shown in Figure 28, by quantity, over one half of the logs exported are shipped from the Port of Tauranga, with the remainder of New Zealand's ports shipping less than 10 % each.

### 5.2.2 Timber Production and Exports

Approximately 260 sawmills in New Zealand produced 2,763,000 m<sup>3</sup> of sawn timber in 1994. As shown in Figure 30 this is just a slight increase from 2,173,000 m<sup>3</sup>, which was produced in 1991.

**FIGURE 30: SAWN TIMBER PRODUCTION**



Source: Ministry of Forestry, *Statistical Release: Production & Stocks of Sawn Timber June 1994 (Provisional)*, 1994c, and the INFOS database, Statistics New Zealand using the item code:

Total Sawn Timber — FLTq.SBEA3.

Note: This series includes both sawn timber from natural forests as well as planted production forests.

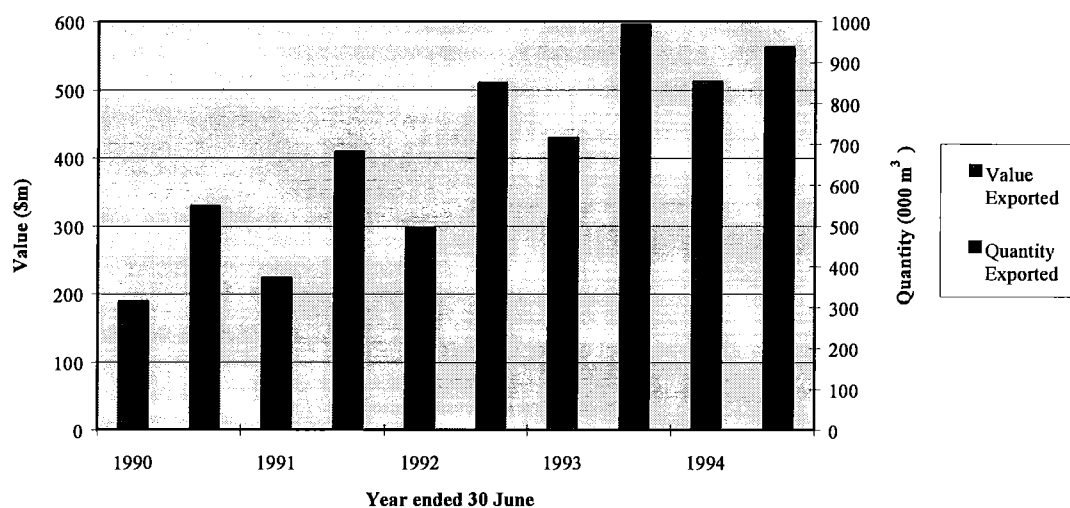
In 1992 the Ministry of Forestry surveyed 249 sawmills and found that a relatively large number of small mills (defined as those whose output is less than 4,500 m<sup>3</sup> p.a.) produced only 7 % of the total national production. In contrast, a small number of large mills (defined as those whose output is more than 50,000 m<sup>3</sup> p.a.) produced 56 % of the national production (Ministry of Forestry, 1993c).

34 % (or 938,000 m<sup>3</sup>) of the current sawn timber production is exported. This timber exported has a value of \$NZ 512 million, and is equivalent to 2,064,000 m<sup>3</sup> of roundwood. This is shown in Figure 31 which also reveals that the value of sawn timber exported has doubled since 1991. This increase is due to both an increase in international timber prices and an increase in the amount of timber exported. The



increase in timber exported is made possible by the increase in timber production while domestic consumption has remained constant.

**FIGURE 31: THE VALUE AND QUANTITY OF SAWN TIMBER EXPORTED**



Source: Ministry of Forestry, Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Total Timber — 4407.10, 4407.21, 4407.22, 4407.23, 4407.91, 4407.92, 4407.99.

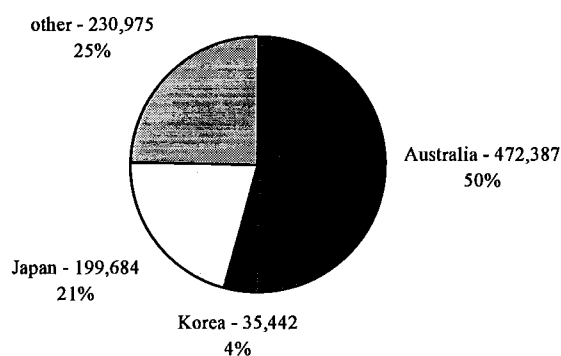
Note:

- (1) Items are NZ\$ free on board (f.o.b.) and may include items for which no quantities are given.
- (2) This series includes both sawn timber from natural forests as well as planted production forests.

**FIGURE 32: SAWN TIMBER EXPORTS BY QUANTITY TO EACH COUNTRY**

**(YEAR ENDED 30 JUNE 1994)**

**(TOTAL SAWN TIMBER EXPORTS 938,000 M<sup>3</sup>)**



Source: Ministry of Forestry, Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

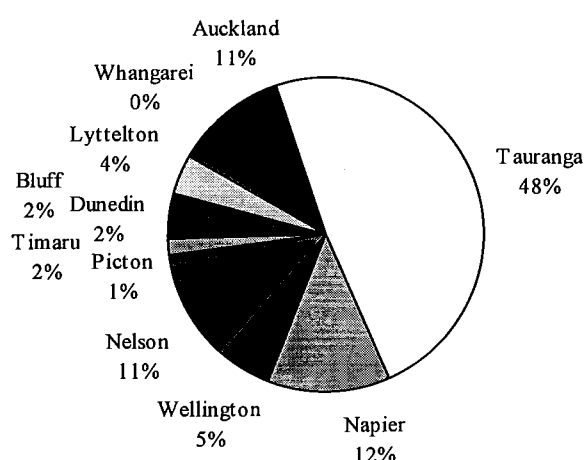
Total Timber Production — 4407.10, 4407.21, 4407.22, 4407.23, 4407.91, 4407.92, 4407.99.

Note: This series includes both sawn timber from natural forests as well as planted production forests.

As is shown in Figure 32 half of New Zealand's sawn timber exports are shipped to Australia. The other two large purchasers of New Zealand's sawn timber exports are Korea and Japan.

As shown in Figure 33, by quantity, nearly one half of the sawn timber exported is shipped from the Port of Tauranga, which mirrors the position of log exports. Again, reflecting the log position, the remaining ports ship around 10 % or less each.

**FIGURE 33: SAWN TIMBER EXPORTS SHIPPED FROM EACH PORT BY QUANTITY  
(YEAR ENDED JUNE 1993)**

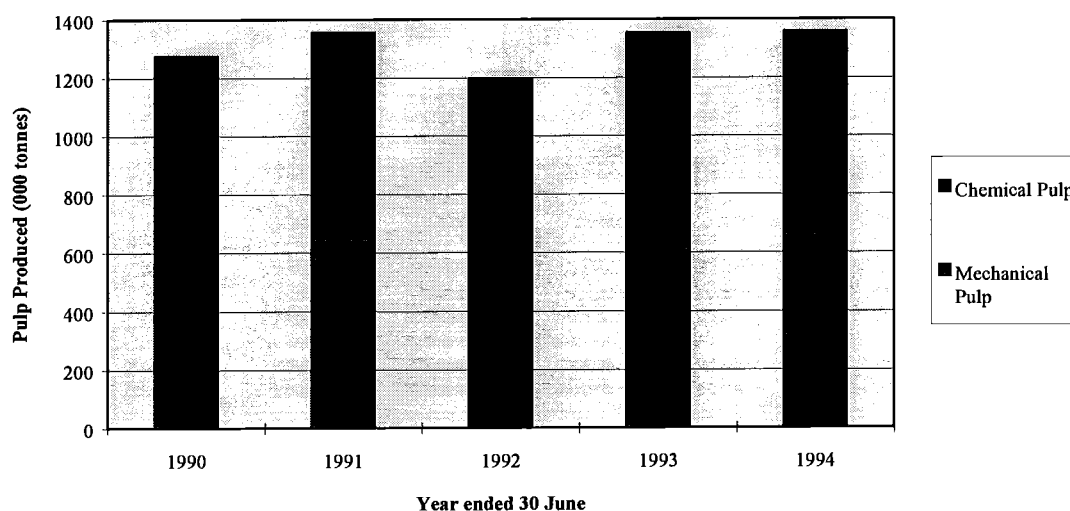


Source: Jayne, V. (ed.), "Directory and Year Book", *New Zealand Forest Industries*, Vol. 25, No. 1, 1994.

### 5.2.3 Pulp Production and Exports

As shown in Figure 34, the production of pulp has remained relatively stable over the past few years with just a slightly lower level of production in the 1992 year. There are two main methods of producing pulp. Mechanical pulp, produced by physically separating wood fibres in an energy-intensive process, is very suitable for newsprint and can be bleached if a higher quality is required. Chemical pulp, produced by "cooking" wood chips in a chemical solution at high temperatures, is strong and well suited to the production of packaging papers. Currently, 665,187 tonnes of mechanical and 691,885 tonnes of chemical pulp is produced. This combines to a total of 1,359,080 tonnes from New Zealand's eight pulp and paper mills (Ministry of Forestry, 1992a).<sup>51</sup>

<sup>51</sup> This figure is not the sum of the two components due to rounding in the source figures.

**FIGURE 34: PULP PRODUCTION**

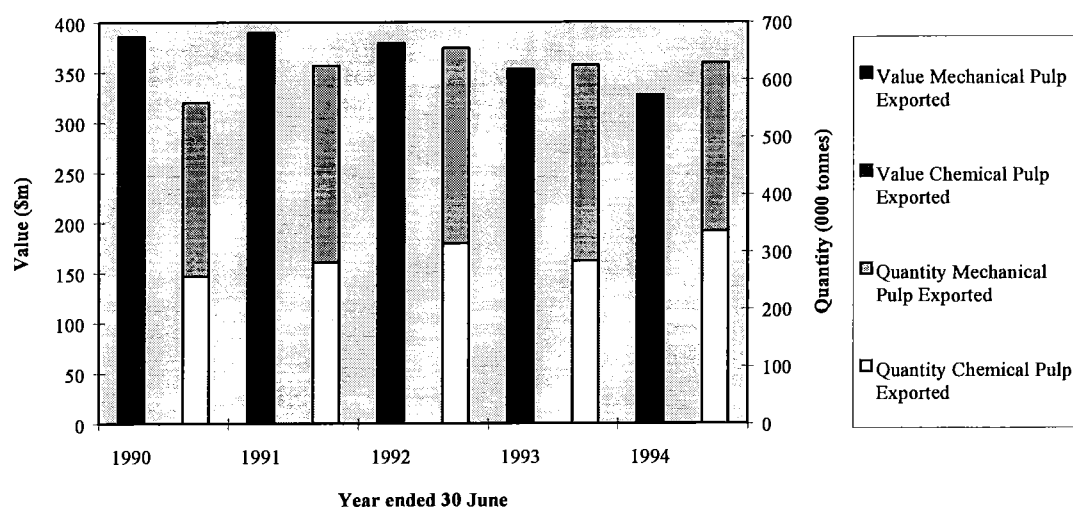
Source: Ministry of Forestry, Statistical Release: Production & Stocks of Pulp, Paper and Paperboard September 1994 (Provisional), 1994h, and the INFOS database, Statistics New Zealand using the item code:

Total Pulp — FLTg.SPFA

Note:

- (1) Mechanical Pulp includes thermo and chem-thermo mechanical pulp.
- (2) Chemical pulp includes semi-chemical pulp.

New Zealand exports pulp in its raw form and also processes pulp into paper for domestic consumption and export. 46 % (or 628,928 tonnes) of the current pulp production is exported, and this has a value of \$NZ 327 million and is equivalent to 2,346,000 m<sup>3</sup> of roundwood. Figure 35 shows the value and quantity of mechanical and chemical pulp exported. The figure reveals that although the quantity exported has remained constant, the value of this export market has fallen marginally.

**FIGURE 35: THE VALUE AND QUANTITY OF PULP EXPORTED**

Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

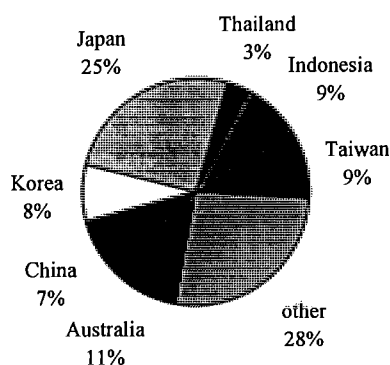
Pulp — 4701, 4702, 4703, 4704, 4705, 4706.

Note:

- (1) Items are NZ\$ free on board (f.o.b.) and may include items for which no quantities are given.
- (2) Mechanical Pulp includes thermo and chem-thermo mechanical pulp.
- (3) Chemical pulp includes semi-chemical pulp.

Although Japan purchases 25 % of New Zealand's pulp exports, the remainder of the export sales are to a large number of countries, most of which purchase less than 15 % of the total exports.

**FIGURE 36: PULP EXPORTS BY QUANTITY TO EACH COUNTRY**  
(YEAR ENDED 30 JUNE 1994)



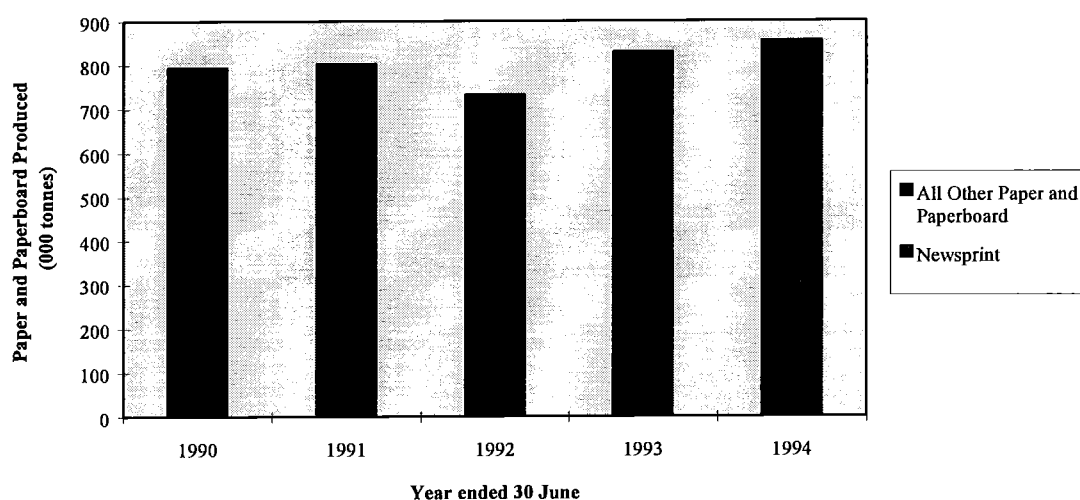
Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Pulp — 4701, 4702, 4703, 4704, 4705.

### 5.2.4 Paper and Paperboard and Exports

New Zealand's eight pulp and paper mills produce a wide range of products, from tissue paper to newsprint, and from packaging paper to corrugated liner board. As shown in Figure 37 the production of paper and paperboard has remained relatively stable over the past few years with just slight increases in the level of production. Currently, 841,165 tonnes of paper and paperboard is produced.

**FIGURE 37: PAPER AND PAPERBOARD PRODUCTION**

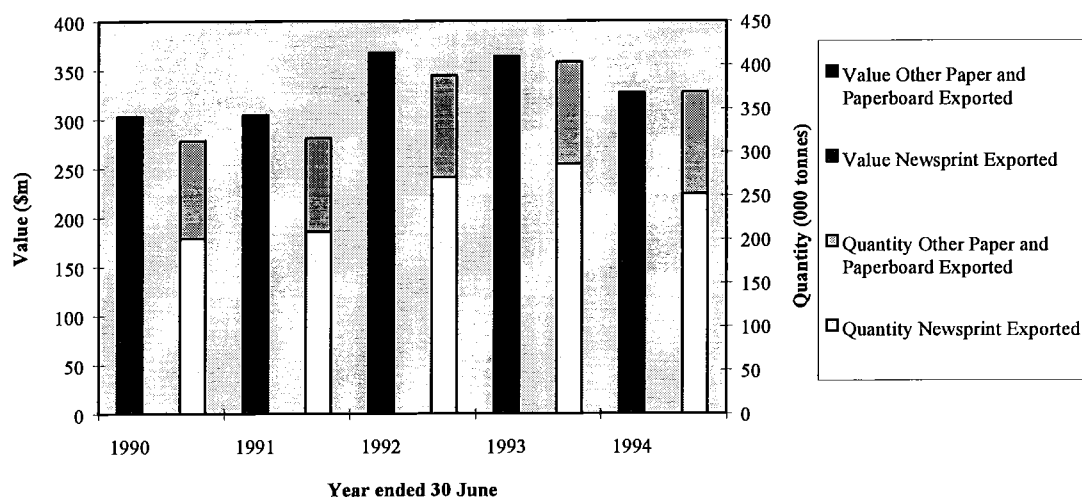


Source: Ministry of Forestry, *Statistical Release: Production & Stocks of Pulp, Paper and Paperboard September 1994 (Provisional)*, 1994h, and the INFOS database, Statistics New Zealand using the item codes:

Total Paper and Paperboard—FLTg.SPGA

Note: All other paper and paperboard includes printing and writing paper, other paper and paperboard.

44 % (or 368,773 tonnes) of the production is exported, and this has a value of \$NZ 327 million and is equivalent to 1,356,000 m<sup>3</sup> of roundwood. Figure 38 shows the value and quantity of newsprint, and other paper and paperboard, exported. The figure reveals that both the value and quantity exported have increased marginally.

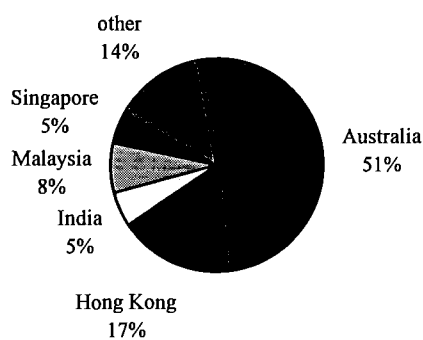
**FIGURE 38: THE VALUE AND QUANTITY OF PAPER AND PAPERBOARD EXPORTED**

Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Newsprint — 4801.

Total Paper and Paperboard — 48.

As Figure 39 shows, Australia is the biggest purchaser of New Zealand's paper and paperboard products.

**FIGURE 39: PAPER AND PAPERBOARD EXPORTS BY QUANTITY TO EACH COUNTRY (YEAR ENDED 30 JUNE 1994)**

Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Newsprint — 4801.

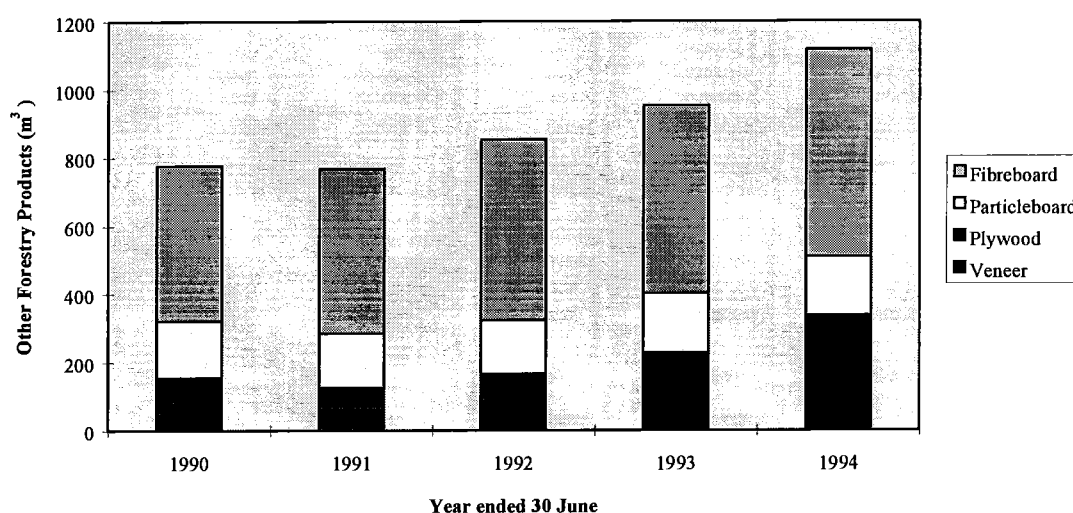
Total Paper and Paperboard — 48.

### 5.2.5 Other Forestry Products

Wood-based panel products that are produced in New Zealand include veneer, plywood, particleboard, and fibreboard. The production of these groups is shown in Figure 40. There are also a number of other products such as woodchips, wooden furniture etc, but no production data is available on these commodities.

Wood-based panel products are made by a range of processes. These include peeling logs to make veneer for plywood, blending compressed fine wood chips with glue to produce particleboard, or compressing and heating sheets of wood fibres (with or without glues) to form fibreboard. High quality pruned radiata pine produces logs that can be used for making knot free veneer from the clearwood. This can be used as a finishing surface on furniture and joinery. Lower quality veneers are layered and glued to make construction grade plywoods, which are used for building and packaging. The knotty core is chipped or pulped to form other wood products. These groups of products are very heterogenous.

**FIGURE 40: PRODUCTION OF OTHER FORESTRY PRODUCTS**



Source: Ministry of Forestry, *Statistical Release: Production & Stocks of Veneer, Plywood, Particleboard & Fibreboard 1994 (Provisional)*, 1994i, and the INFOS database, Statistics New Zealand using the item codes:

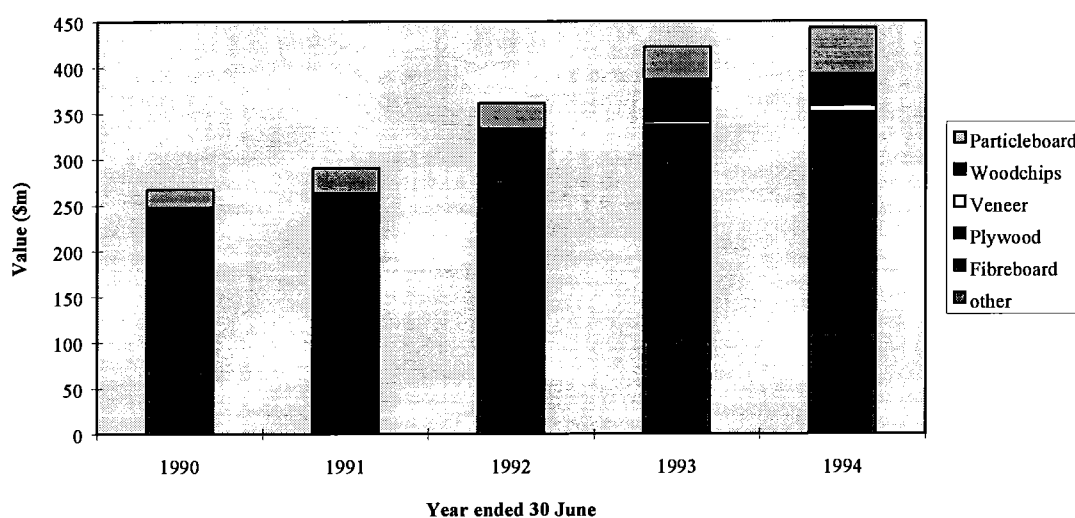
Other Forestry Products — Plywood — FLTq.SMAA  
 — Particleboard — FLTq.SMBA  
 — Fibreboard — FLTq.SMDA

Note:

- (1) Plywood production includes laminated veneer timber production since March 1992.
- (2) Fibreboard includes hardboard, softboard, medium density fibreboard and triboard.

The value added nature of these products has resulted in increasing total values for each of these products as shown in Figure 41. Technological advancements are likely to continue to enhance the value of these products.

**FIGURE 41: THE VALUE OF OTHER FORESTRY PRODUCTS EXPORTED**



Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Plywood — 4408., 4412.

Particleboard — 4410.

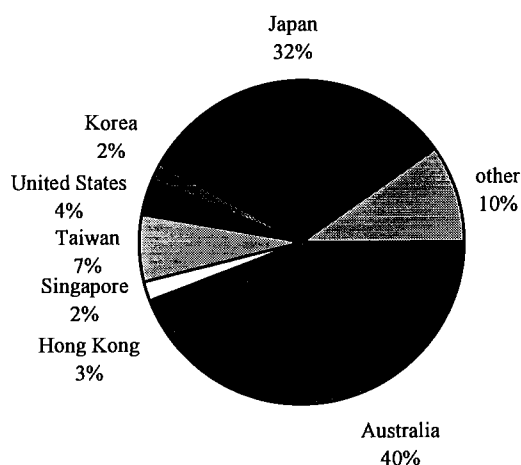
Fibreboard — 4411

Wood chips — 4401.21, and 4401.22.

Japan and Australia are the biggest purchaser of these products, as is shown in Figure 42, and a number of other countries purchase the remainder in smaller quantities.



**FIGURE 42: EXPORTS OF OTHER FORESTRY PRODUCTS BY VALUE TO EACH COUNTRY  
(YEAR ENDED 30 JUNE 1994)**



Source: Ministry of Forestry, *Statistical Release: Exports of Forestry Products for the year ended 30 June 1994, 1994f*, and the INFOS database, Statistics New Zealand using the following item codes from the Harmonise System:

Plywood — 4408., 4412.

Particleboard — 4410.

Fibreboard — 4411

Wood chips — 4401.21, and 4401.22.

### **5.3 Summary**

World consumption of wood has been increasing with population growth, and improving living standards. Predictions show that world roundwood consumption will increase by more than 40 %, from the current 3.4 billion m<sup>3</sup> per year to over 5 billion m<sup>3</sup> per year by 2010.

In the year ended June 1994, New Zealand's forestry export receipts totalled NZ\$ 2.467 billion, representing 12.89 % of total merchandise export revenues. Forestry is New Zealand's third largest export earner, after meat and dairy products, and accounts for 6 % of Gross Domestic Product.

New Zealand's log supply for the year ended June 1994 was 15.838 million m<sup>3</sup>. Of approximate equal size, this harvest is demanded in raw form by the export market, the pulp and paper industry, and the sawmilling industry. 64 %, or the equivalent of 10.060 million m<sup>3</sup>, of total roundwood removals are ultimately exported in some form.

Logs form the largest proportion of roundwood equivalent exports. 4,313,000 m<sup>3</sup> of the total log harvest is exported in raw form, which equates to 38 % of exports by roundwood equivalent. These logs have a value of \$NZ 781 million, which equates to

32 % of total exports by value. 51 % of these logs are shipped from the Port of Tauranga, and 45 % goes to Korea and 38 % to Japan.

Sawn timber makes up the second largest proportion of roundwood equivalent exports. 2,763,000 m<sup>3</sup> of sawn timber produced in New Zealand, and 938,000 m<sup>3</sup> (or 34 %) is exported, which equates to 18 % of exports by roundwood equivalent and 21 % by total. This sawn timber has a value of \$NZ 512 million. 48 % of this sawn timber is shipped from the Port of Tauranga, and 50 % goes to Australia and 21 % to Japan.

## **6. Conclusion**

Planted production forests cover 1.3 million hectares, or 5 %, of New Zealand's 27 million hectares of land area. The biggest concentration of plantations is in the central North Island. Radiata pine is the predominant species of the planted forest area. This species makes up just over 3 % of the global softwood forests, and a third of this resource grows in New Zealand.

A tree yields a composite of joint log products, not a single homogeneous quality of log. However, the joint log products are graded into homogeneous classes for the purpose of sale contracts using scientific methods so that sales may be made on the basis of physical description — “sight unseen”. Logs may be graded under two different regimes: for export markets, or for the domestic market. Similarly, sawn timber may be scientifically graded under the Standards Association of New Zealand's “Timber Grading Rules”, to produce homogeneous timber classes.

While the markets for logs and timber are not formalised, export grade logs and timber must flow through a port, and a marshalling agent is usually used as part of the marketing method. Logs and timber can be stored, but not for significant time periods.

New Zealand's current log supply is 15.838 million m<sup>3</sup>, and will increase in the future. Forecasts estimate that with additional afforestation of 50,000 hectares per annum, the available wood harvest could reach as high as 40 million m<sup>3</sup> by the year 2020.

Although New Zealand's output is insignificant in global terms, it is of significance in Asia Pacific, because of excellent proximity to this market. After an

increase in sustainable yield to 25 million m<sup>3</sup>, which is predicted to occur over the next fifteen years, New Zealand's market share will increase to 8.5 %. Further, New Zealand's harvest will become increasingly important globally because large proportions of easily assessable "old growth" forests, and environmental pressures, are reducing the supply from forest areas which are not self-sustaining. New Zealand's planted production forests are, however, all managed on a sustainable yield so the supply can be maintained.

In the year ended June 1994, New Zealand's forestry export receipts totalled NZ\$ 2.467 billion, representing 12.89 % of total merchandise export revenues. Forestry is New Zealand's third largest export earner, after meat and dairy products, and accounts for 6 % of Gross Domestic Product.

Of approximately equal proportions, the log harvest is demanded in raw form by the export market, the pulp and paper industry, and the sawmilling industry. 64 %, or the equivalent of 10.060 million m<sup>3</sup>, of total roundwood removals are ultimately exported in some form.

Logs form the largest proportion of roundwood equivalent exports. 4,313,000 m<sup>3</sup> of the total log harvest is exported in raw form, which equates to 38 % of exports by roundwood equivalent. These logs have a value of \$NZ 781 million, which equates to 32 % of total exports by value. 51 % of these logs are shipped from the Port of Tauranga, and 45 % goes to Korea and 38 % to Japan.

Sawn timber makes up the second largest proportion of roundwood equivalent exports. 2,763,000 m<sup>3</sup> of sawn timber produced in New Zealand, and 938,000 m<sup>3</sup> (or 34 %) is exported, which equates to 18 % of exports by roundwood equivalent and 21 % by total. This sawn timber has a value of \$NZ 512 million. 48 % of this sawn timber is shipped from the Port of Tauranga, and 50 % goes to Australia and 21 % to Japan.

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**PART V:**  
**A LOG OR TIMBER FUTURES CONTRACT**

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## **1. Introduction**

The objective of Part IV is to determine the feasibility and likelihood of success of a futures market for the forestry industry. This assessment is based on the compatibility of the forestry industry which was overviewed in Part IV, and the conditions and requirements for a feasible and successful contract as determined in Parts II & III.

Part V determines the size of all sub-markets within the forestry industry, and concludes that the markets for sawn timber and logs are the two largest within the forestry industry. Part IV also concludes that sawn timber and logs are products which are scientifically classified into homogeneous grades for marketing purposes because of the different values of log grades, even although grading is a costly scientific process. Although there is no formal market for the domestic log and timber markets, logs and timber for the export market all flow through New Zealand's ports. Both logs and timber are largely exported to a small number of countries in Pacific Asia, and are exported predominantly from just one port. Part V focuses on these two products as they are the most likely to support successful futures trading.

As some information was unavailable for the analysis performed in this section, a survey questionnaire was sent to exporters, sawmills, and some domestic timber suppliers.

This part is divided into sections which reflect the necessary prerequisites, and factors of successful innovation, as concluded in Part III.

## **2. The Survey Questionnaire**

### **2.1 Introduction**

Although Part IV provides a detailed account of the forestry industry, some information was necessarily obtained from a survey. The aim of the survey was to assess the interest and understanding of potential users, and to aid the development of contract terms in accordance with industry practices on the most suitable contract base. A copy of the survey is included in Appendix One. Results of the survey are detailed throughout Parts V and VI, where appropriate.

## **2.2 The Development of the Questionnaire**

An extensive preliminary analysis was required to develop a suitable questionnaire to extract the required information. This preliminary analysis yielded tentative hypotheses about the conditions and characteristics of logs and sawn timber, and their compatibility with futures trading. The preliminary analysis also indicated that these commodities could possibly be traded on a futures market, and that there was a significant amount of interest from the industry concerning this possibility, which reflects a demand for a contract.

The preliminary analysis involved several interviews with industry experts and a literature search. The interviews were mainly conducted by telephone. The industry experts interviewed included: CME contract development staff member, Tom Matthews; SFE contract development staff members, Stephen Chambers and Jeff Weeden; Directors on the Board of the New Zealand Forestry Exchange (the secondary market for immature forests); Ministry of Forestry staff; University of Canterbury Forestry Department staff; NZFOE staff; and a number of log and sawn timber sawmill owners and exporters. Many thanks goes to all these people.

As expected, the literature search failed to provide any specific guidelines for developing questionnaires specific to futures contract innovation. However, a number of general studies exist which consider mail survey design, and some of these studies were reviewed and their principles used. Brogo and Gall (1989) outline the major steps in designing a survey:

- Define objectives.
- Define population, and select representative sample.
- Construct questionnaire items.
- Design questionnaire format.
- Pre-test questionnaire.
- Include cover letter.
- Use a follow-up procedure.
- Consider non-respondents.

Oppenheim, 1966, also discusses a number of relevant issues, including:

- Questionnaire design problems.
- Pilot studies.
- Question sequence, type, and wording (for example, the use of open and closed end questions).
- Administration and anonymity issues.

Interviews with industry experts provided valuable information. First, that logs and timber are scientifically graded for marketing. The methods of classification, and specifications of the various grades of logs and sawn timber, are detailed in Part IV.

Second, although immature forests are generally able to be estimated for their total wood volume using mathematical models, they are not as yet able to be scientifically measured and classified into homogeneous commodity groups. Forestry audits, however, may at some time in the future allow homogeneous categories, by age class, to exist. Presently there are only a small number of very young forests which are growing under this management regime.

Third, the normal size classes in which logs and sawn timber are sold was determined. Because both grade categories and size classes exist, questions 10, 11, and 12 were developed to assess the most common grade categories and size classifications for both logs and sawn timber, and also to assess the size of the markets for each of these grades and sizes. These questions are necessary for two reasons: first, the greatest likelihood of a successful contract will occur if the deliverable commodity of the contract is of the most common grade and size specifications of all the commodities for which price risk may be hedged using the contract; and second, the larger the underlying physical market, the greater the likelihood of success. The log section was split into two questions, a domestic and export log question, to reflect the different grading methods for each of these two markets.

Finally, the questionnaire needed to attempt to discover:

- How far in advance the capacity to hedge, and knowledge of forward prices, would be useful for the industry.

- What months of the year the capacity to hedge, and knowledge of forward prices, would be most useful for the industry.
- What months of the year the flow of logs and timber are greatest.

This led to the development of Questions 6, 7, and 8, and all these questions are necessary because they lead to the development of contract specifications.

Questions 3, 4, and 5, were added to assess the interest and understanding of the futures market by the industry, so that the potential hedging demand for a contract could be assessed. These questions are required because the level of knowledge about the hedging benefits of futures and their ability to forecast prices has caused the failure of many futures markets around the world, for example, the wool futures contract in New Zealand. Specifically, these questions were aimed at assessing:

- Whether fluctuating log and/or timber prices, or the lack of forward price information, is a problem for the industry.
- Whether the industry is familiar with the hedging and price discovery roles of futures markets.
- What perception the industry has of different asset bases.

The industry is categorised by a large variance in operations size. A small number of industry participants constitute a large proportion of the market. Consequently, Questions 1, 2, and 9 were added to determine the proportions of the industry captured by the survey, and were also used to assess the market concentration. The question also allowed an analysis of market sides, that is, a check to see if a futures market would have greater trading on one side (for whatever reason).

The final draft of the survey was reviewed by two forestry industry experts, and assessed for the length of time which was required to complete it and the understanding of the questions. Subsequently, the survey was made slightly shorter, and revised so it could be better comprehended.

A cover letter was sent with the survey, and a reminder notice was sent three weeks later. All letters were personalised to a company director or manager where possible.



### **2.3 The Population Surveyed and the Response Rate**

The sample surveyed included log exporters, sawmills, and wholesale timber merchants. The names and addresses of those surveyed were obtained from New Zealand Forest Industries Journal (1994) "Directory and Year Book". The Ministry of Forestry, which compiles these lists, claims that they consist of almost the entire populations of the business groups (except for approximately the smallest 2 % by market share). Appendix Two lists the entities which were surveyed. Some of the businesses listed in the Forest Industries Journal were listed under two (or even three) of the category headings and in several instances subsidiary companies were listed in addition to the parent company. In these cases only one survey form was sent to the head office or parent company.

92 entities were sent survey forms.<sup>52</sup> 54 entities (59 %) responded to the survey. Although, by number of entities, this is a relatively low response rate, it actually almost encapsulates the entire market by volume. The respondents represented 88 % of the log selling market, and 98 % of the log purchasing market. They also represented 87 % of the timber selling market, and 35 % of the timber purchasing market.<sup>53</sup>

This response rate compares very favourably with that achieved by the CME when they surveyed sawmillers in the U.S. before listing their lumber contract. Only 11 % responded to their survey (CME, verbal comment, 1994). Although, this would be considered a low response rate for an academic survey (Brogo and Gall, 1989, and Oppenheim, 1966), it appears to be acceptable for the development of contracts by futures exchanges where the response bias is low (SFE, CBT, CME, verbal comments).

The high response rate (in terms of market share) was possibly achieved by the fact that fluctuating prices, and the lack of forward price estimates, does appear to be a very large problem for the industry.

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52 After removing those entities who were sent a survey form when one was also sent to their parent, and those who were sent a survey which was wrongly addressed.

53 The percentage of respondents from each category as defined in the Forest Industries Journal, "Directory and Year Book" is not possible to report because many of the respondents refused to be identified, and either replied to the survey by fax or removed the cover letter before returning the survey. This does not affect the results of the survey because the market share captured by the survey is the relevant issue.

## **2.4 Bias**

The sample represented almost the entire population by market share. Consequently, it is expected that the sample is very representative of the industry, and non-response bias is insignificant. As the variance in respondents' answers were small, the response bias is considered small and immaterial. Late respondents tended to give answers consistent with early responses.<sup>54</sup>

## **3. Price Volatility and The Demand for a Contract**

### **3.1 Introduction**

Volatile prices in the underlying market are necessary for a feasible and successful futures market, because volatile prices cause price risk, and the existence of price risk is essential if a futures contract is to provide hedging benefits. If there is no hedging benefit the contract will fail because there will be no hedging demand. Similarly, speculators will not trade the contract if there is no movement in prices because there will be no possibility of financial gain for them.

### **3.2 Price Volatility**

#### **3.2.1 The Price Series Data Examined**

Price data for Japan — A, Japan — J, and Korean — K grade logs was collected. Monthly price data was collected for Japan — A grade of logs from January 1989; Japan — J grade from February 1992; and quarterly data for Korean — K grade from March 1992. As these markets are not formalised at a central location, and because log grade specifications change over time, these price series are not available for a longer time period. Price series data is not available on a more regular basis. This data was supplied by the Ministry of Forestry, and the writer wishes to thank Richard Sullivan for the provision of this information.

Some components of the “Wood Price Index”, a series which includes logs and poles, wood chips, and sawn timber for export, were also assessed for volatility. The

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54    Curtis (1989) discusses the issues of response and non-response bias.

Wood Price Index is composed of two main series: (1) "Logs and Poles" and (2) "Sawn Timber", which were both analysed. Additionally, each of these series were broken into country components, and the main two country components were also analysed. This is the only price series which relates to timber that is available. These price series are produced and released on a quarterly basis by Statistics New Zealand, and they are composed from the INFOS database which holds sales data for all exports from New Zealand in \$NZ, (f.o.b.). Unfortunately price series data on a more regular basis is not available.<sup>55</sup> Again, there is actually no formal market, and it is noted that these series are simply an aggregation of export data. Because of this quarterly time frame structure, and because of the informality of the market, less weight has been applied to the results derived from these indexes.

### 3.2.2 Measures of Volatility

Volatility can be simply defined as fluctuation or change. Therefore to measure volatility, price changes, or first differences, of the raw price series were taken. Percentage changes were used to standardise the fluctuations and allow comparisons.

Because price changes can be both positive and negative, the average actual price change is a meaningless measure, and as such, the first measure used was the Average Absolute Value of Percentage Price Changes (Avge. Abs. Value of % Price Chng.). The second and third measure was the Standard Deviation of the Absolute Percentage Price Changes (Std. Dev. of Abs. % Prc. Change) and the Standard Deviation of the Actual Percentage Price Changes (Std. Dev. of Actual % Price Chng.) respectively. The Standard Deviation of the Raw Price Series (Std. Dev. of Raw Price) was included only for interest as no comparison can be made using this statistic, because it is not standardised in any way.

Comparisons were made between the volatility in the price series of New Zealand logs and sawn timber, and the volatility of the price series which are hedged against using the U.S. Lumber and Plywood Futures Contracts. These contracts were considered for this comparison because they are similar contracts to that under

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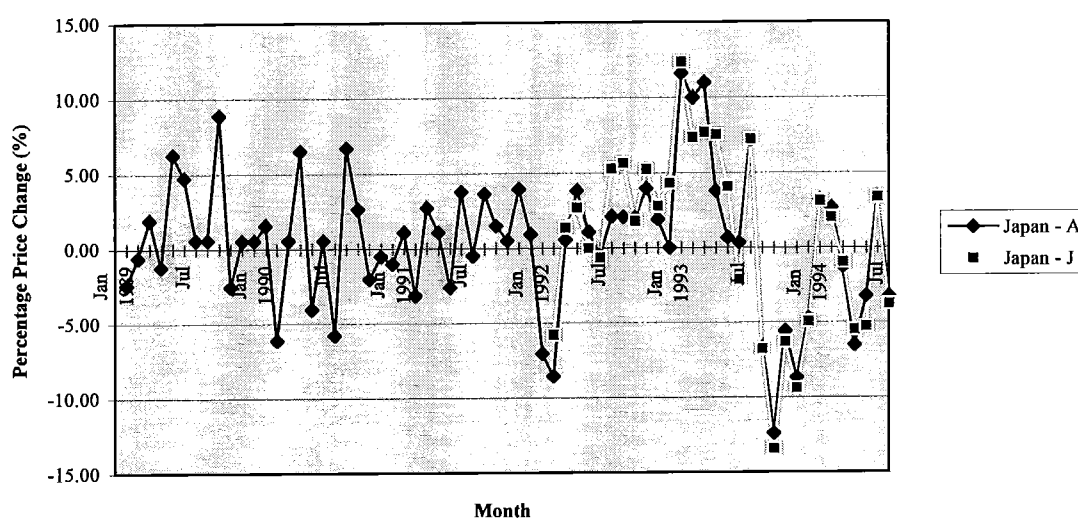
<sup>55</sup> This is because the index is an aggregation, and it is therefore necessary to produce the index over a reasonable time frame so that the average smooths large sale contracts.

consideration in New Zealand. Two monthly lumber and two plywood price series were used in this comparison: random lengths 2 x 4 of quality standard and better; studs, utility and better; sanded exterior AC 3/8 in.; and sheathing CDI 3/8 in. These data series were supplied by the CME, and the writer wishes to thank Tom Matthews for the provision of this information.

### 3.2.3 Results

Figure 43 — Figure 45 illustrate the volatile nature of price series of log and sawn timber markets by graphically representing the percentage change over time. Log prices for the Japan — A grade rose from \$NZ 215 per m<sup>3</sup> in January 1993 to a high of \$NZ 329 per m<sup>3</sup> in August; however, just five months later the price fell back to \$NZ 221 per m<sup>3</sup>. This equates to a 53 % increase in prices over seven months, followed by a 33 % fall in the following five months. Japan — J experienced similar price movements.

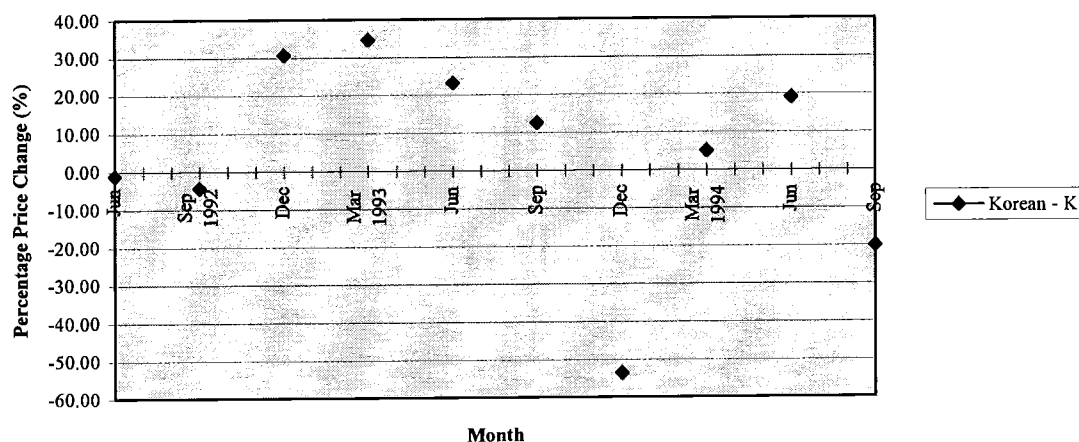
**FIGURE 43: VOLATILITY OF JAPANESE EXPORT GRADE LOGS**



Source: Forestry Statistics Section, Ministry of Forestry.

Note: This monthly data was collected from: 1989 - (August) 1994, for Japan — A; and (February) 1992 - (August) 1994, for Japan — J.

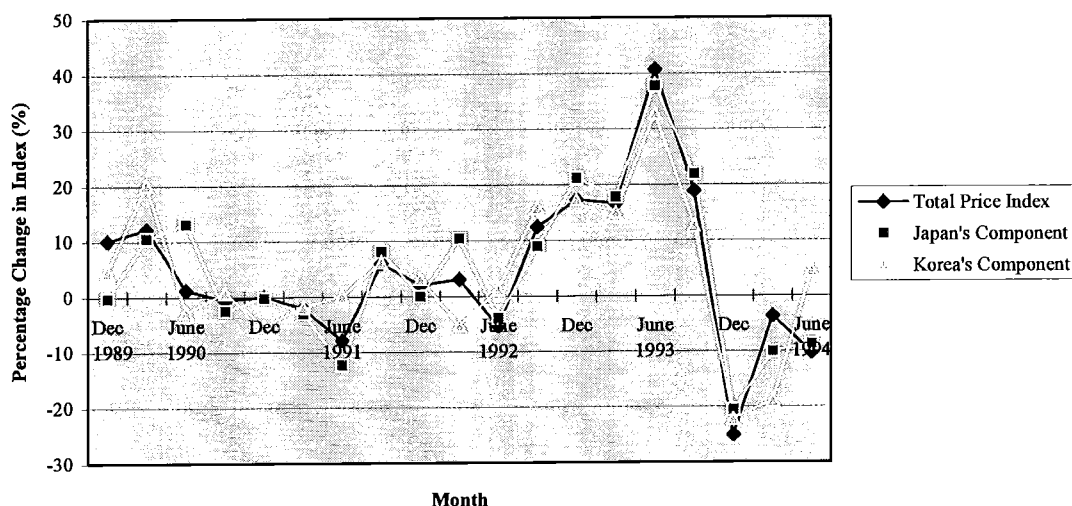
Log prices for the Korean — K grade rose 144 % from \$NZ 88 per m<sup>3</sup> in September 1992, to a high of \$NZ 215 per m<sup>3</sup> in September 1993. However, by December 1993, the price had fallen by over 50 %, to just \$NZ 100 per m<sup>3</sup>. The trend then again reversed, and prices increased 25 % over the following six months to \$NZ 125 per m<sup>3</sup>.

**FIGURE 44: VOLATILITY OF KOREAN EXPORT GRADE LOGS**

Source: Forestry Statistics Section, Ministry of Forestry.

Note: This monthly data was collected from (March) 1992 - (September) 1994.

The Ministry of Forestry Total Price Index of logs and poles more than doubled in twelve months, moving from 1346 in September 1992, to 3080 in September 1993. It then fell back 25 %, to 2307 the following quarter.

**FIGURE 45: VOLATILITY OF LOG INDEXES**

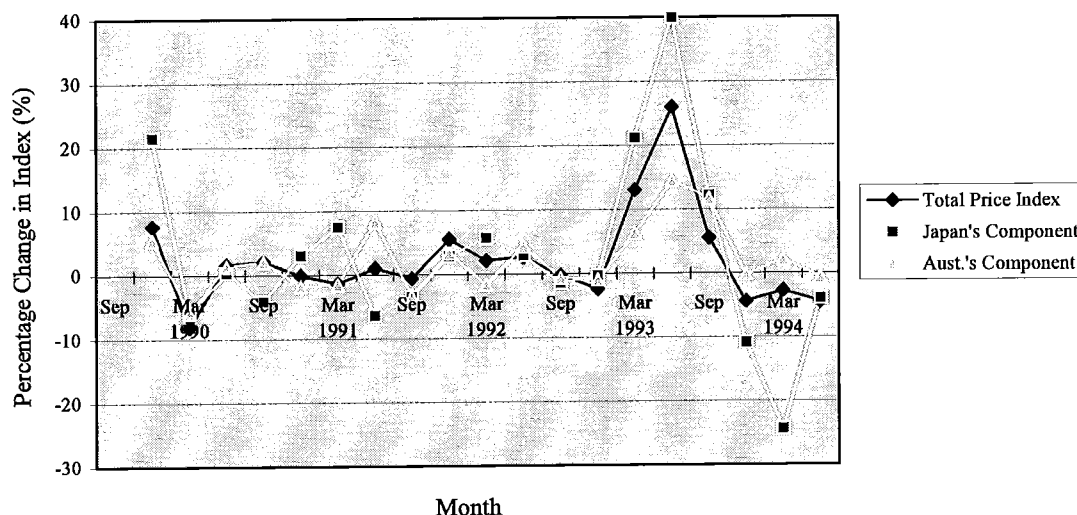
Source: Forestry Statistics Section, Ministry of Forestry, Statistical Release: Forestry Products Export Price and Volume Indexes June 1994 Quarter (provisional), 1994K, and the components of the index was sourced from the INFOS database, Statistics New Zealand, using the following series identifiers:

Total Logs — 4403.10.0001, 4403.10.0009, 4403.10.0019, 4403.10.0021, 4403.10.0029, 4403.20.0001, 4403.20.0009, 4403.20.0011, 4403.20.0019 and 4403.99.0000.

Note: The time period which this quarterly data was collected was 1989 - (June) 1994.

The Ministry of Forestry indexes of sawn timber, shown in Figure 46, have also experienced similar levels of volatility.

**FIGURE 46: VOLATILITY OF SAWN TIMBER INDEXES**



Source: Forestry Statistics Section, Ministry of Forestry, Statistical Release: Forestry Products Export Price and Volume Indexes June 1994 Quarter (provisional), 1994K, and the components of the index was sourced from the INFOS database, Statistics New Zealand, using the following series identifiers:

Total Timber — 4407.10, 4407.21, 4407.22, 4407.23, 4407.91, 4407.92, 4407.99.

Note: The time period which this quarterly data was collected was 1989 - (June) 1994.

These extreme fluctuations mirror similar levels of price movement in the U.S. plywood market during 1967 and 1968 which set the stage for the development of the plywood contract. In 1967, plywood prices (Sanded Exterior AC 3/8 in.) rose from under \$US 70 per MSF at the beginning of the year to about \$US 95 by July, retreating to a little over \$US 70 toward the end of the year. By the middle of 1968 the price had rebounded to approximately \$US 100.

Table 10 reveals volatility statistics, and compares the level of volatility with the U.S. Random Lengths Lumber and Plywood markets at the time futures contracts were being considered for those markets, and also at the present.

The average absolute value of price changes for Japan — A grade was 3.5 %, and 4.9 % for Japan — J. This is less than the average for Korean — K grade which was 20.4 %. However, as a quarterly data series was used for Korean — K, as opposed to monthly data, the two results are not compatible. It would be expected that the average

absolute value of price changes over a three month period could conceivably be three times as large as that statistic for a one month time period even if the same level of volatility existed. This point must also be noted when interpreting the results from the index price series, which are also quarterly price series.

The standard deviation of both absolute and actual percentage price changes also illustrates the volatile nature of log prices. The standard deviation of absolute percentage price changes was 3.0 for Japan — A grade, and 3.1 for Japan — J. For the same reason as stated above, the Korean — K grade standard deviation of absolute percentage price changes is higher at 15.3. The standard deviation of actual percentage price changes was 4.6 for Japan — A grade, 5.8 for Japan — J, and 25.1 for Korean — K.

The all encompassing log component of the Wood Price Index substantiates these results. The level of volatility in the total Japanese market is greater than volatility in the two most common log grades, and most certainly compatible with the U.S. Random Lengths Lumber and Plywood markets. Clearly, the reason for this is that the remainder of the market which is not captured in the two main log grade price series is very volatile. The opposite conclusion is evident in the Korean market, where the level of volatility is less in the total market than in the main grade.

Similar conclusions are derived with respect to the sawn timber market. The average absolute value of price changes was 4.8 %, the standard deviation of absolute percentage price changes was 5.9, and for actual changes was 7.2.

Whereas Japan does not appear to have as greater volatility in the log market as Korea, Japan has a greater level of volatility in the sawn timber than Australia.

**TABLE 10: VOLATILITY STATISTICS OF LOGS AND TIMBER**

VOL. MEAS.	NEW ZEALAND PRICE SERIES										UNITED STATES SERIES***				
	Log Price Series						Timber Price Series				Comparison Series				
	Log Prices*			Wood Price Index**							Lumber		Plywood		
				Log Components			Timber Components			Total					
	Japan — A	Japan — J	Korean — K	Japan	Korea	Total	Japan	Aust.	Total		Ran. 2x4 Std. or bet.	Studs, Util. and bet.	Sanded Ext. AC 3/8 in.	Sheathing CDI 3/8 in.	
Avg. Abs. Value of % Price Chng.	3.5	4.9	20.4	11.1	10.0	10.3	9.4	4.0	4.8	5.5	2.7	2.6	12.1	2.3	
Std. Dev. of Abs. % Prc. Change	3.0	3.1	15.3	9.3	8.9	9.9	10.1	3.8	5.9	6.9	3.3	3.7	14.6	2.8	
Std. Dev. of Actual % Price Chng.	4.6	5.8	25.1	13.7	12.8	13.6	13.5	5.0	7.2	8.4	4.3	4.5	18.9	3.6	
Std. Dev. of Raw Price	38.0	43.2	41.1	631	509	559	371	175	222	371	2.5	2.3	46.4	3.1	

Sources:

\* "Log Prices", were sourced from Forestry Statistics Section, Ministry of Forestry. This monthly data was collected from: 1989 - (August) 1994, for Japan — A; (February) 1992 - (August) 1994, for Japan — J; and (March) 1992 - (September) 1994, for Korean — K.

\*\* "Wood Price Index", were sourced from Forestry Statistics Section, Ministry of Forestry, Statistical Release: Forestry Products Export Price and Volume Indexes June 1994 Quarter (provisional), 1994K, and the components of the index was sourced from the INFOS database, Statistics New Zealand, using the following series identifiers:

Total Logs — 4403.10.0001, 4403.10.0009, 4403.10.0019, 4403.10.0021, 4403.10.0029, 4403.20.0001, 4403.20.0009, 4403.20.0011, 4403.20.0019 and 4403.99.0000.

Total Timber — 4407.10, 4407.21, 4407.22, 4407.23, 4407.91, 4407.92, 4407.99.

The time period which this quarterly data was collected was 1989 - (June) 1994.

\*\*\* "United States Series", are used for a comparison and were sourced from the CBT. The time period which this monthly data was collected was the two years prior to the listing of the Lumber and Plywood contracts, i.e., 1964 - 65 for Lumber, and 1968 - 69 for plywood.

Notes:

- (1) Volatility in the Random Length Lumber currently measures:

<u>VOL. MEASURE</u>	<i>Random Length Lumber<sup>#</sup></i>
Avg. Abs. Value of % Price Chng.	4.2
Std. Dev. of Abs. % Price Change	3.6
Std. Dev. of Actual % Price Chng.	5.6
Std. Dev. of Raw Price	46.1

<sup>#</sup> Data was sourced from Random Lengths: The Weekly Report on North American Forest Products Markets

- (2) Volatility in other forestry sub-markets was also assessed:

<u>VOL. MEASURE</u>	<i>Wood Pulp*</i>	<i>Wood Manufacture</i>	<i>Paper and Paper Products</i>	<i>Forestry Products</i>	<i>Total Exports</i>
Avg. Abs. Value of % Price Chng.	4.6	3.8	3.3	3.1	2.0
Std. Dev. of Abs. % Price Change	3.2	2.9	2.6	3.5	1.5



Std. Dev. of Actual % Price Chng.	5.6	4.7	4.2	4.5	2.4
Std. Dev. of Raw Price	103.3	102.9	58.3	132.7	77.7

\* Data for all sub-markets was sourced from Forestry Statistics Section, Ministry of Forestry, Statistical Release: Forestry Products Export Price and Volume Indexes June 1994 Quarter (provisional), 1994K.

Table 10 also shows that for each log grade, each statistical measure of volatility was compatible with the same measure for the U.S. Random Lengths Lumber and Plywood markets at the time futures contracts was being considered, and also at present. One grade of plywood displays a higher level of volatility than most of the New Zealand price series, but the other grade of plywood and the two lumber markets display comparatively similar results, and in some cases less volatility than the New Zealand price series. This indicates that the level of volatility in the log markets in New Zealand is of sufficient magnitude to support a feasible futures market.

Finally, Table 10 also shows the level of volatility in other forestry markets in New Zealand. In all cases the statistics are similar for each of the markets, and are also of a similar level to the comparative U.S. markets.

### **3.3 Hedging Demand**

#### **3.3.1 The Problem of Fluctuating Prices and Lack of Forward Price Information**

Statistically, log and sawn timber prices appear to be very volatile. This is particularly evident in comparison with the volatility of the underlying asset of the U.S. Lumber Futures Contract. However, no level of price volatility can guarantee hedging demand *per se*, as participants in the market may be reducing their price risk via some other mechanism. Therefore, hedging demand will exist only if price volatility is a problem for those trading in the physical market.

The survey results showed that volatile prices are a problem for those trading in the physical markets. The response rate, and the enthusiasm of respondents in replying to the survey, is indicative of this. 42 respondents (78 %) indicated that fluctuating prices and/or the lack of forward price information was a problem for their business. By market share, 64 % of respondents who supply logs and 68 % who purchase logs indicated that fluctuating prices and/or the lack of forward price information was a problem for their business. In the timber market, 77 % of respondents who supply

timber and 48 % who purchase timber indicated that it was a problem. Many comments were made by respondents which highlight the problem:

As a medium sized sawmill in New Zealand we see the industry future for domestic markets as volatile.

Quarterly log price changes . . . are very difficult for us to work with . . .

In most instances, fluctuations have to be absorbed . . . we never know what price we will be required to pay in 3 months.

Fluctuating log prices are making it extremely difficult for budgeting . . . and . . . pricing our sales.

Some respondents had obviously recognised the problem and considered possible solutions:

We are looking seriously at purchasing our own forestry supply at this very time because the problem is so extensive.

The future will require collective marketing.

Yes . . . and we would consider anything to help the present situation.

We have attempted to negotiate long term contracts with [the forestry owner who supplies us], but this is difficult also, as fluctuating log prices are not only a problem for us, but also our supplier.

Even some of the very large companies recognise volatile prices as a problem:

[Our company] is trying to differentiate products with service, quality and consumer focus — towards a commodity market (brand recognition) — to combat the problem.

We believe that fluctuating prices will continue into the future, and that our company's success will depend on us reducing our exposure to fluctuating log prices through vertical integration. We are considering this possibility because timber end products don't appear to have as volatile prices as logs do. However, vertical integration is not an easy solution!

The eleven respondents who stated that fluctuating prices and/or the lack of forward price information was not a problem could be classified into two groups. The first group appeared to consist of larger companies who did not deal in logs or timber of the grade types stipulated in the survey. These companies may have therefore been selling to an overseas associate or been hedging their price risk on another market. The second group appeared to consist of traders with a very small volume of trade.

Only a small number of respondents rejected the concept of futures outright as a means of reducing price risk in the log and timber markets. However, it must be noted

that the large majority of respondents indicated that they did not understand futures markets:

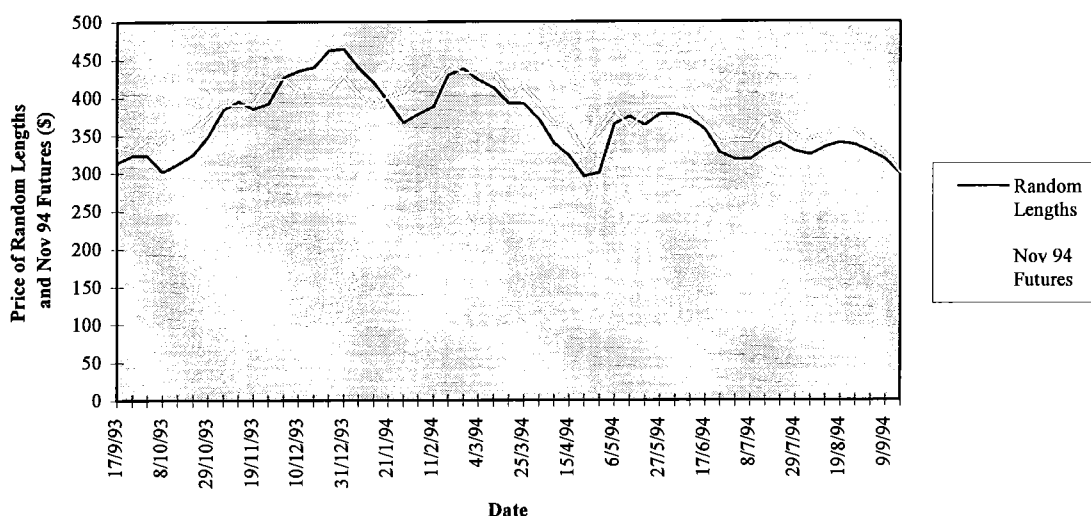
Existing conditions make a futures market doubtful in that: (i) Logs are too heterogeneous and grades cannot be defined with sufficient precision; (ii) Individual companies, such as [very large ones], are sufficiently large to influence the log or timber market and hence a futures market.

Although I wish you all the best, I think that there wouldn't be enough trading (?).

### 3.3.2 A Futures Contract Based on a Forestry Market Which Has Hedging Demand

It is impossible to claim with certainty that a futures contract will be successful, and will provide the necessary hedging benefits required by market participants, prior to the listing of a contract. However, Figure 47 shows the convergence of the prices of the November 1994 U.S. Lumber Futures Contract and the underlying commodity, Random Lengths Lumber, as an indication that a futures market can provide hedging benefits to a forestry industry. The fact that the two prices converge close to the expiration date means that users of the contract are able to achieve significant hedging benefits as discussed in Part II.

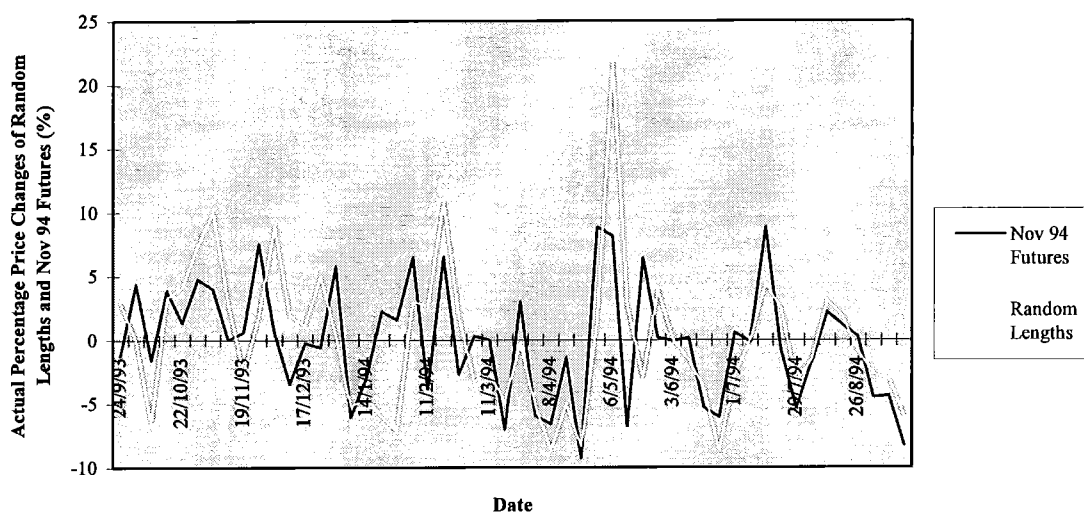
**FIGURE 47: CONVERGENCE OF THE NOVEMBER 1994 U.S. LUMBER FUTURES CONTRACT AND RANDOM LENGTH LUMBER PRICES**



Source: Reuters.

The correlation between price movements in these two markets is high, which means that the contract can be used successfully for hedging over a period which ceases before expiration. The correlation coefficient of price movements in the two markets is 0.776. This means that 77.6 % of the price movements in the futures contract is paralleled by price movements in the physical commodity. A graphical illustration of parallel price movements is given in Figure 48 which shows the percentage price changes in the two markets.<sup>56</sup>

**FIGURE 48: PERCENTAGE PRICE CHANGES OF RANDOM LENGTHS AND THE NOVEMBER 1994 FUTURES CONTRACT**



Source: Reuters.

<sup>56</sup> The correlation coefficient is explained in full detail shortly.

This discussion begs the question of the application of the U.S. Lumber Futures Contract in hedging price risk in the New Zealand forestry markets. Unfortunately, price risk in New Zealand forestry markets cannot be hedged successfully using the U.S. Lumber Futures Contract because the price movements of these two international markets are not correlated. This issue will be addressed shortly..<sup>57</sup>

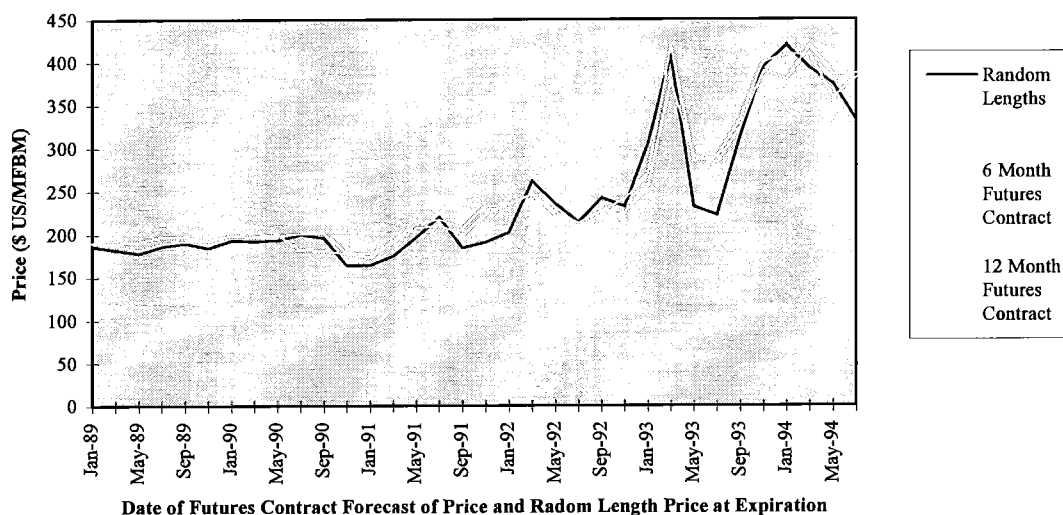
The ability of the futures market to be used as a means of hedging price risk appears to be well known among respondents in the various markets. By market share, 89 % of respondents supplying logs and 83 % purchasing logs indicated that they were familiar with how the futures market may be used to hedge against fluctuating prices. In the timber market, 62 % of respondents supplying timber and 78 % purchasing timber indicated that they were familiar with the concept.

As discussed in Part II, the futures market also has a price forecasting role, and so the ability of the U.S. Lumber Futures price to forecast Random Length Lumber prices at expiration was assessed. The last 35 expired contracts, from January 1989, were reviewed for their usefulness as predictors of lumber prices by comparing the value of each futures contract 6 and 12 months before expiration with the actual lumber price on each expiration date. Figure 49 provides the results, by graphically representing on the same date the value of Random Length Lumber, and the U.S. Lumber Futures prices from 6 and 12 months earlier. As the lines in the figure follow each other closely, the futures market can be considered as a good predictor of the future spot price of Random Length Lumber.

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<sup>57</sup> The contract however, is known to be used by some very large New Zealand forestry companies which export timber to the U.S. in cases where their timber is of similar specifications to the U.S. Random Lengths Lumber and its value has correlating price movements.

**FIGURE 49: PRICE FORECASTS OF RANDOM LENGTH LUMBER BY THE U.S. LUMBER  
FUTURES CONTRACT**



Source: Reuters.

The statistical relationship for the sample analysed is detailed in Table 11. The correlation coefficient of 0.965 with the 6 month contract, and 0.947 with the 12 month contract, represents an excellent ability to predict future prices. If this could be achieved in New Zealand the benefits for the industry would be exceptional.

**TABLE 11: CORRELATION STATISTICS OF RANDOM LENGTH LUMBER AND THE U.S.  
LUMBER FUTURES PRICES FROM 6 AND 12 MONTHS EARLIER**

<i>Futures Contract</i>	<i>Correlation With Random Lengths</i>
6 Month Futures Contract	0.9656
12 Month Futures Contract	0.9478

Source: Reuters.

The ability of the futures market to be used as an indicator of forward prices was also well known among respondents in the various markets. By market share, 89 % of respondents supplying logs and 83 % purchasing logs indicated that they were familiar with how the futures market may be used as an indicator of forward prices. In the timber market, 83 % of respondents supplying timber and 78 % purchasing timber indicated that they were familiar with the concept.

### **3.3.3 Hedging Demand of New Zealand Log and Timber Market Participants**

Those respondents who indicated that they understood the role of the futures market in hedging price risk or indicating forward prices were asked if they thought a futures market would be useful for their industry such that they would use it. By market share, 60 % of respondents who supply logs and 61 % who purchase logs indicated that they thought a futures market would be useful and that they would use a contract. Approximately 1 % indicated that they did not know.

In the timber market, 71 % of respondents who supply timber and 33 % who purchase timber indicated that they thought a futures market would be useful and indicated that they would use a contract. Approximately 10 % indicated that they did not know.

There are no comparative hedging demand figures for other proposed futures contracts so it is difficult to claim certainty of success of a new contract, but it appears there is undoubtedly a significant amount of hedging demand.

### **3.4 Speculation Demand**

Volatility is also necessary to attract speculation demand because without price volatility there will be no possibility of financial gain for speculators. It has been shown statistically that log and sawn timber prices are very volatile so speculation demand should exist.

However, it is difficult to assess speculation demand even with the knowledge of the level of price volatility. This is because, although speculators demand requires volatility (amongst some other factors, for example, good information flow), the function is difficult to quantify. Nearly every company which currently speculates on futures contracts in New Zealand and Australia is unwilling to discuss their speculation positions, and how they decide whether to speculate on a new derivative.<sup>58</sup> As a result, a survey to discover speculation interest is destined to fail.

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<sup>58</sup> This is possibly because of the recent large losses which have taken place in derivative markets, and the subsequent tightening of information which is provided considering the positions taken.

However, both the SFE and the CME publish figures concerning the make-up of market participants. The volume of trading for the four most widely traded futures contracts on the SFE is estimated to be 40 % speculative.<sup>59</sup> The CME estimate that trading in the U.S. Lumber Futures Contract is 90 % speculative. But, because this is one of their larger markets, it is not particularly relevant to New Zealand. Trading in smaller markets on the CME, of similar size to the New Zealand forestry market, is normally 40 - 60 % speculative (CME, verbal comment, 1994). The NZFOE guesstimate that the level of speculation on their contracts is similar to those levels in Australia (NZFOE, verbal comment, 1994).

### **3.5 Conclusion**

The level of volatility in New Zealand log and timber price series was examined because volatile prices are necessary to attract both hedging and speculation demand. Volatility was evaluated graphically and using statistical measures, and was compared against the volatility of the U.S. Random Lengths and Plywood markets.

The average absolute value of price changes for Japan — A grade log was 3.5 %, and 4.9 % for Japan — J. This is less than the average for Korean — K grade which was 20.4 %. However, as a quarterly data series was used for Korean — K, as opposed to monthly data, the two results are not compatible. It would be expected that the price changes over a three month period could conceivably be three times as large as that statistic for a one month time period. This point must also be noted when interpreting the results from the timber price series. The average absolute value of price changes in the timber market was 4.8 %. For each log and timber price series, each statistical measure of volatility was compatible with the same measure for the U.S. Random Lengths Lumber and Plywood markets at the time futures contracts were being considered, and also at present.

Because no level of price volatility can guarantee hedging demand *per se*, participants of the log and timber markets were asked whether fluctuating prices and/or

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59 These three contracts are:

- Share Price Index Future.
- Treasury Bond Future.
- Bank Bill Future.



the lack of forward price information was a problem. 42 respondents (78 %) indicated that it was. By market share, 64 % of respondents who supply logs and 68 % who purchase logs indicated that it was a problem. In the timber market, 77 % who supply timber and 48 % who purchase timber indicated that it was a problem for them.

The role of the U.S. Lumber Futures Contract in hedging and forecasting was assessed, and this contract appears to be successful.

The role of the futures market in hedging and forecasting appears to be very well known by respondents in New Zealand log and timber markets.

Those respondents who indicated that they understood the role of the futures market in hedging and forecasting were asked if they thought a futures market would be useful for their industry, such that they would use it. By market share, 60 % of respondents who supply logs and 61 % who purchase logs indicated that they thought a futures market would be useful and that they would use a contract. In the timber market, 71 % of respondents who supply timber and 33 % who purchase timber indicated that they thought a futures market would be useful and indicated that they would use a contract.

It is difficult to estimate speculation demand on the NZFOE, but using figures from the SFE and CME it is estimated that 40 % of current trading in New Zealand is speculative.

## **4. Large Cash Market**

### **4.1 Introduction**

An underlying physical market which is large in size is important to the success of a futures market for five reasons. First, the larger the number of participants in the cash market and the larger the volumes traded, the larger the interest in futures trading, and hence the greater the likelihood of success of the futures market. Second, larger markets result in higher levels of liquidity, and hence the convergence of cash and futures markets will be enhanced. High levels of liquidity also lower trading costs. Third, market manipulation cannot occur as easily if supply and demand is large, in proportion to individual interests. These points are important in the context of the market size of

the deliverable commodity. Fourth, market structure is important because, for example, if the industry is geared to deal with price risk through vertical integration, the demand for hedging will be non-existent. Finally, the size of the cash market is important in terms of both volume and value.

In beginning to focus on the largest market to develop a successful futures contract, Part IV focused on logs and sawn timber, as these are the two largest of the forestry sub-markets and consist of commodities which are able to be scientifically described. Price volatility has been determined for both these markets and the levels of volatility appears similar. In this respect neither would appear a better market than the other on which to base a futures contract. However, although the analysis so far has been able to focus on these markets, a specific grade and quantity on which the futures contract should be based has not been determined within either of the markets. This is determined in this section using a correlation analysis and the results of the survey, which detail the largest market of a deliverable grade.

The correlation analysis determines which grade has the highest relationship in terms of price with other grades and markets. This would appear the best grade on which to base a futures contract because it will apply to the widest number of hedgers (including cross-hedgers). An assessment of the largest market of a deliverable grade, and size in which it is produced, is necessary because the contract must call for a deliverable commodity which constitutes a large market. If both these analyses produce the same grade of log or timber, then this grade and common size will provide the best base for a futures contract with maximum hedging benefit.

Once the price relationships and common grades have been determined, liquidity of the futures market using some assumptions from the U.S. Lumber Futures Contract is estimated.

This section also considers the possibility of trading the U.S. Lumber Futures Contract. This is assessed by determining the correlation between this market and New Zealand forestry markets.

## **4.2 The Underlying Market and Correlation Analysis**

### **4.2.1 Introduction**

One of the major features of a futures contract is that it identifies a specific quality and quantity of a commodity — the deliverable commodity. Thus, all those who deal in futures know exactly what the contract relates to, and hence they are able to place a value on the contract “sight unseen”. For this reason a futures contract is very clear, specific, and precise. As a result, only a very small group trading in the underlying commodity are able to accept or make delivery of the commodity. However, others in the general trade of products related to the deliverable grade can use the contract if there is a link in terms of price between the varied products they produce and the deliverable grade defined by the futures contract. These traders are called cross-hedgers.

In the cash market these relationships are easy to identify: kiln dried timber usually sells for so much more than green timber; and planed timber for so much more than rough timber. In most cases rule-of-thumb and judgement based on experience can estimate these differences with acceptable accuracy. However, a cross-hedger would need to know with a fairly high degree of accuracy the price relationship of the product in question and the deliverable grade. More particularly, the cross-hedger would need to know if price of the related product would change by the same, or a proportional amount, if the price of the deliverable grade changed. Clearly, the stronger the relationship, the greater the hedging benefit; and the greater the number of products with a relationship, the greater the number of possible cross-hedgers and users of the futures contract.

### **4.2.2 The Correlation Coefficient**

A linear correlation analysis was used to examine the relationships between price series of different forestry products. The analysis measured the degree of linear association between two sets of observations (i.e. a series of prices over time for one log

grade compared to another). A perfect linear relationship would give a correlation coefficient of 1.0, indicating that price changes in one item occur at a constant ratio to price changes in the other item. High correlation coefficients (close to 1.0) indicate that when price changes occur the prices of the two items move together at a nearly constant ratio. The higher the coefficient, the more closely the two prices will have a corresponding movement. If, for instance, a correlation coefficient of 0.90 is obtained this means that 81 % ( $0.90^2$ ) of the movement of one is mirrored in the movement of the other. Because the correlation coefficient is squared to obtain the value of explained movement the statistic does not function in a linear manner. This is explained by way of example. For a coefficient of 0.95 about 90 % of the movement in one item is reflected in the movement of the other; for a coefficient of 0.99 it is about 98 %. Thus, a 0.99 coefficient is considerably more important than a 0.95 coefficient; the former leaves only 2 % of the price movement unreflected, the latter 10 %.

The statistic does not imply that movement in the price of one item causes the movement in the other, nor in fact that the parallel movements are caused by the same external force; it simply provides evidence, based on historical data, that price movements of the items mirror each other in direction and size to the degree specified by the correlation coefficient.

Statistically, the correlation coefficient “r” equals the square root of the explained variation divided by the total variation. Therefore, the percentage of the variation explained by the assumed linear relationship between the two price series is the square of the correlation coefficient or “r” (NewBold, 1991, Chapter 12).

#### **4.2.3 The Price Series Data**

The linear correlation analysis was used to examine the relationships between price series of different forestry products sourced in New Zealand; between price series of different grades of commodities within product groups; and between price series of product groups which are sold to different export destinations.

The same price series as those that were used for the volatility analysis were examined. A price series for stumpage is not available in New Zealand, even although the stumpage market is quite active, and so stumpage prices from the U.S. were correlated with U.S. log prices. This data was obtained from the United States

Department of Agriculture (1989) price statistics, "U.S. Production, Trade, Consumption, and Price Statistics 1950-87". This data book has a large number of price series for different areas, so the relationship was estimated using average stumpage prices and log prices for southern pine sold from private owners in Louisiana.

#### 4.2.4 Results

The results of the correlation analysis are revealed in Table 12. The price series for the log grades are highly correlated. This is particularly so between the two Japanese grades, which have a correlation coefficient of 0.99, but the correlation coefficient between both the Japanese grades and Korean — K grade of 0.93 is also very high.

The correlation coefficient between all the log grades and the Log Price Index is lower than expected. However, this can possibly be explained by the effect that exported pulp logs will have on the log index price series. Pulp, and consequently pulp logs, have a negative correlation coefficient with all the price series examined, so when the price series for pulp logs is added to other log price series, the new series will have a lower correlation with the original non-pulp log price series.

Japanese — A grade has the highest correlation coefficient with all other log price series.

The Japanese — A grade of log also has the highest correlation coefficient of the three log grade price series with all the timber price series (with the exception of timber exported to Australia). The CME indicated, in verbal comment, that although obviously the higher the correlation coefficient the better, a correlation coefficient of 0.80 and better is acceptable. Therefore, the correlation coefficient of 0.82 and 0.88 with the Japanese — A grade logs is acceptable.

The Total Log Price Index has a higher correlation coefficient with timber than Japanese — A grade logs, but has a lower correlation coefficient with the three specific grades of log.

**TABLE 12: CORRELATION OF VARIOUS FORESTRY MARKET PRICE SERIES**

	Japan-A Log Prices	Japan - J Log Prices	Korean - K Log Prices	Total Log Price Index	Japan's Comp. of Log	Korea's Comp. of Log	Total Timber Price Index	Japan's Comp. of Tim.	Aust.'s Comp. of Tim.	Total Exports Index	Wood Index	Pulp Index	Wood Manu- facture Index	Paper and Paper Products Index	Forestry Products
<b>Logs</b>															
Japan - A Log Prices	1.00														
Japan - J Log Prices	0.99	1.00													
Korean - K Log Prices	0.93	0.93	1.00												
Total Log Price Index	0.91	0.88	0.80	1.00											
Japan's Comp. of Log	0.89	0.85	0.77	1.00	1.00										
Korea's Comp. of Log	0.93	0.93	0.86	0.98	0.98	1.00									
<b>Timber</b>															
Total Timber Price Index	0.82	0.72	0.60	0.95	0.96	0.92	1.00								
Japan's Comp. of Tim.	0.88	0.83	0.74	0.96	0.96	0.96	0.94	1.00							
Aust.'s Comp. of Tim.	0.68	0.48	0.37	0.88	0.89	0.82	0.96	0.83	1.00						
<b>Other</b>															
Total Exports Index	0.63	0.68	0.65	0.53	0.52	0.59	0.47	0.49	0.33	1.00					
Wood Index	0.90	0.86	0.77	1.00	0.99	0.97	0.98	0.96	0.91	0.54	1.00				
Pulp Index	-0.71	-0.56	-0.36	-0.72	-0.73	-0.72	-0.76	-0.71	-0.74	-0.19	-0.75	1.00			
Wood Manufacture Index	0.56	0.45	0.32	0.84	0.86	0.81	0.91	0.82	0.92	0.35	0.78	-0.58	1.00		
Paper and Paper Products Index	-0.51	-0.41	-0.22	-0.76	-0.77	-0.73	-0.78	-0.74	-0.74	-0.50	-0.69	0.50	-0.76	1.00	
Forestry Products	0.87	0.86	0.79	0.98	0.98	0.96	0.95	0.95	0.89	0.57	0.98	-0.62	0.79	-0.66	1.00

The Total Exports Index has a reasonably good correlation coefficient with all the price series examined, and therefore some hedging benefit would be available to all those who deal in any forestry sub-markets. The Wood Index has a high correlation coefficient with logs and timber because it is composed of these two markets. Interestingly, both the Pulp Index and the Paper and Paper Products Index have a negative correlation coefficient with all forestry sub-markets. The reason for this is that while log and timber demand is driven more by population and housing needs, pulp and paper demand is a function of business activity, because most of the pulp is ultimately made into paper and consumed by businesses. Both the Wood Manufacture Index and the Forestry Products Index appear also to have reasonable levels of correlation with logs and sawn timber. Although these markets are very small, there may be some hedging benefit for some of the wide range of articles which combine to form these indexes.

The correlation coefficient between stumpage and log prices in the U.S. is 0.991, as shown in Table 13. This is an extremely strong relationship, and although this result is derived from U.S. data and is therefore only indicative of the New Zealand situation, the relationship is also expected to be strong. This is simply because stumpage and logs are an almost identical commodity. The only difference is that stumpage is mature logs that are still standing as against ordinary logs which are cut down.

**TABLE 13: CORRELATION OF U.S. STUMPAGE AND LOG PRICE SERIES**

	STUMPAGE	LOGS
Stumpage	1	
Logs	0.9915	1

Source: Ulrich, A.H. (ed), U.S. Production, Trade, Consumption, and Price Statistics 1950-87, United States Department of Agriculture, Forest Service, Miscellaneous Publication No. 1471, December 1989.

Note: The price series used were average stumpage prices and log prices for southern pine sold from private owners in Louisiana.

The domestic log market is unlikely to have perfect correlation with the export market because of a number of price parity issues. As a result it is not correct to assume that domestic price equals export price at wharf gate less transport costs. However, increases in one market are likely to mirror increases in the other, and so the correlation coefficient should be very high.

Some of the price parity issues which need to be considered are:

- Differences in measurement methods. With cubic metres (used in the domestic market) the s.e.d. is taken through the centre of the log, but with the Japanese Agricultural Standard (JAS) (used for exports to most Asian countries) it is taken through the pith.
- Export s.e.d. requirements. Export shipments must be supplied so that the average s.e.d. is above the specified minimum. This minimum usually does not coincide with the minimum s.e.d. used in domestic grade specifications, and the difference in the minimum and average s.e.d., and the actual s.e.d., will be lost to the seller in the export market, whereas in the domestic market it would have been accounted for since cubic metres would have been used.
- Both the export and domestic log markets require the sale contract to be specified using length requirements. However, the two markets are usually supplied different length classes, the domestic market receiving shorter logs than the export market. This creates a parity difference because longer logs have higher value than shorter logs.
- Recovery per hectare. If a given forest is cut solely for export, a larger proportion of pulp and small logs is generated because of the strict average s.e.d. and length requirements. If it is cut for the domestic market, which has a lower s.e.d. requirement and more flexible length specifications, there is usually a greater recovery of sawlog per hectare. Comparisons of returns from export and domestic cutting should be per hectare rather than price per grade.
- Difference in costs incurred for trading in the two different markets. For example, marketing costs are greater in the export market, monitoring log length measurements and shifting crews to achieve the correct balance of lengths, and average s.e.d. is greater in the export market.
- The domestic market is presently more of a seller's market (with a limited number of suppliers and extra capacity at most sawmills) whereas the export market is more of a buyer's market (with a larger number of buyers and sellers).



### 4.2.5 Conclusion

Prices for Japanese — A grade logs have the highest correlation coefficient with other log grades and timber price series. Japanese — A grade also has some price correlation with other forestry markets, but does not correlate with the price series of pulp and paper. The Total Log Price Index has a higher correlation coefficient with timber than Japanese — A grade logs, but has a lower correlation coefficient with the three main grades of log. As an indicator of the New Zealand situation, U.S. stumpage and log prices are very highly correlated. In conclusion, the price series for Japanese — A grade logs would be best to use as the deliverable grade in a futures contract because it has the highest overall correlation with other price series for logs and timber, and the physical market on this log grade will include:

- the secondary market for forestry sales,
- the stumpage market,
- the entire log market, and
- the timber market, except possibly Australian timber.

Using values from Table 9, the total value of the log and timber markets (excluding timber which is exported to Australia) is estimated at \$NZ 1,037 million.

## **4.3 The Most Common Log Grades and Sizes**

### **4.3.1 Introduction**

In determining a deliverable unit which will maximise a futures contract's chance of success, not only should it have a high price correlation with other similar products, but it should also constitute a large deliverable supply. The largest deliverable supply will be the most common grade and size. This was assessed for each of the log markets and the domestic timber market using information from the survey.

Based on the total quantities indicated in question 1, and the estimates of proportions exported and sold domestically which was requested in question 9, the amount of trade in each of the more common log grades, and the sizes in which they are sold, was estimated from the information requested in questions 10 and 11. Question 10 was used to estimate the amount of trade in export grade logs, and question 11 domestic

grade logs. Using the same method, question 12 was used to estimate the amount of trade, and the sizes in which they are sold, in timber grades.

### 4.3.2 The Most Common Export Grade of Logs

As shown in Table 14, the most common export log is Japanese — A grade, and the market for this grade constitutes approximately 70 % of total export log market. Currently, the size of the New Zealand log export market, as determined in Part IV, is 4,313,000 m<sup>3</sup> p.a., and the survey encapsulated 95 % (or 4,093, 325 m<sup>3</sup>) of this market. Based on these figures, it is estimated that 2,976,160 m<sup>3</sup> of Japanese — A grade logs are currently exported annually from New Zealand.

The second most common grade exported is Korean — K. It is estimated that 883,684 m<sup>3</sup> (or 20 % of the total export market) of Korean — K grade logs are currently exported annually. Japanese — J grade was the third most common, of which 348,790 m<sup>3</sup> (or 8 %) are exported. China — C grade is the least common, of which just 104,366 m<sup>3</sup> (or 2 %) are exported.

**TABLE 14: EXPORT LOG MARKET DETAILS**

LOG MARKET GRADE	MARKET DETAILS					
	Market Size (m <sup>3</sup> p.a.)	% of Total	Market Value (\$ NZ m p.a.) <sup>1</sup>	Common Sizes (m)	Percentage Allowed	Ave. Contract Size (m <sup>3</sup> )
Japanese — A	2,976,160	70 %	\$ 622 m p.a.	4.0 8.0 12.0	10% max balance 50% min	2,000 — 5,000
Japanese — J	348,790	20 %	\$ 62 m p.a.	4.0 8.0 12.0	10% max balance 50% min	n/a
Korean — K	883,684	8 %	\$ 88 m p.a.	3.6 5.4 7.3 11.0	balance 10% max balance 40% min	n/a
China — C	104,366	2 %	n/a	4.0 6,8,10	15% max Shipper's option	n/a

Note 1: These estimates have been made under the assumption that Japanese — A grade logs sell for \$NZ 209, Japanese — J grade for \$NZ 179, and Korean — K grade for \$NZ 100. These prices were taken September 1994. These prices do not match the prices used in Table 9, which were year aggregates.

The Japanese — A grade market is worth \$NZ 622 m which makes it the largest export log market by both quantity and value. The second largest market by value is the Korean — K market which is worth \$NZ 88 m.

The survey respondents indicated that the percentage allowed of each length was consistent with that indicated by Table 7 in Part IV. They also indicated that the average quantity of logs sold in Japanese — A grade contracts is between 3,000 m<sup>3</sup> and 5,000 m<sup>3</sup>. There was only one exception, where the respondent indicated that their average contract was 20,000 m<sup>3</sup> (this was a very large company).

#### 4.3.3 The Most Common Domestic Grade of Logs

Table 15 provides both theoretical details the of domestic log market and the results of the survey. Based on recoverable volume, as diagrammatised in the typical log turnout in Part IV, the combined domestic grades L1/L2 should theoretically form the largest markets by volume constituting 36 % of the market.<sup>60</sup> The second most common combined grades should be P1/P2, constituting 28 %. Currently, the size of the New Zealand domestic log market, as determined in Part IV, is 11,525,000 m<sup>3</sup>. Using this information the total volume of L1/L2 logs theoretically traded can be estimated as 4,149,000 m<sup>3</sup> and 3,227,000 m<sup>3</sup> for P1/P2 logs.

However, by theoretical value the order reverses because of the difference in log values. Theoretically, P1/P2 grades constitute 60 % of the value of a tree, where saw logs only combine to form 38.5 % of the total. The P1/P2 market size is therefore estimated at \$ 419 m p.a. where as the L1/L2 market size is only \$ 369 m p.a.

The results of the survey provided slightly different results. The rankings remained the same as the theoretical situation, but the size of the markets differs from that expected. The survey encapsulated 81 % (or 9,365,750 m<sup>3</sup>) of the total domestic log market. Although the combined most common domestic log grades are L1/L2, the market for these two grades constitutes only 31 % of total market, and it is estimated that 3,581,130 m<sup>3</sup> of L1/L2 grade logs are currently sold annually. The second most common grade was P1/P2. 3,395,142 m<sup>3</sup> (or 24 %) of grade P1/P2 is sold. S1/S2 grade was the third most common, of which 3,115,909 m<sup>3</sup> (or 22 %) is sold. S3/L3 grade is the least common, of which just 1,432,819 m<sup>3</sup> (or 10 %) is sold.

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60 After removing the almost worthless recoverable volume of waste and industrial logs.

**TABLE 15: DOMESTIC LOG MARKET DETAILS**

<u>LOG GRADE:</u>	<u>THEORETICAL MARKET DETAILS:</u>			<u>SURVEY RESULT MARKET DETAILS:</u>			
	<i>Market Size (m<sup>3</sup> p.a.)</i>	<i>% of Total</i>	<i>Mkt Value (\$ NZ m p.a.)<sup>1</sup></i>	<i>Market Size (m<sup>3</sup> p.a.)</i>	<i>% of Total</i>	<i>Mkt Value (\$ NZ m p.a.)<sup>1</sup></i>	<i>Ave. Contract Size (m<sup>3</sup>)</i>
L1/L2	4,149,000	36 %	\$ 369 m p.a.	3,581,130	31 %	\$ 319 m p.a.	2 — 5,000
P1/P2	3,227,000	28 %	\$ 419 m p.a.	3,395,142	24 %	\$ 441 m p.a.	n/a
S1/S2	2,182,000	19 %	\$ 194 m p.a.	3,115,909	22 %	\$ 277 m p.a.	n/a
S3/L3	1,958,000	17 %	\$ 174 m p.a.	1,432,819	10 %	\$ 128 m p.a.	n/a

Note 1 Estimates of market values have been made under the assumptions that saw grade logs currently sell for \$NZ 89, and pruned logs for \$NZ 130.

The combined P1/P2 markets are worth \$NZ 441 m which makes them the largest markets by value, although the second largest by volume. The combined L1/L2 markets are the second largest by value, and are worth \$NZ 319 m.

Table 16 provides details of the average contract log lengths and sizes for the two most common grades. The average quantity in contracts of P1/P2 log grades is 6,743 m<sup>3</sup>, and in L1/L2 contracts the average quantity is 4,998 m<sup>3</sup>.

**TABLE 16: AVERAGE CONTRACT DOMESTIC LOG LENGTHS AND SIZES**

<u>LOG GRADE:</u>	<u>LOG LENGTH:</u>					<u>AVE. CONTRACT SIZE:</u>
	6.0 m	5.4 m	4.8 m	4.2 m	3.6 m	
P1/P2	9 %	24 %	38 %	17 %	12 %	6,743 m <sup>3</sup>
L1/L2	29 %	29 %	30 %	5 %	7 %	4,998 m <sup>3</sup>

#### 4.3.4 The Most Common Grade of Timber

As shown in Table 17, the most common timber grade is No. 1 Framing, and this grade constitutes approximately 27 % (or 493,020 m<sup>3</sup>) of the total domestic timber market. Currently, the size of the New Zealand domestic timber market, as determined in Part IV, is 1,825,000 m<sup>3</sup>, and the export market is 938,000 m<sup>3</sup>. These combine to a total market size of 2,763,000 m<sup>3</sup>. The survey encapsulated 73 % (or 1,333,787 m<sup>3</sup>) of the domestic timber market.

No. 1 Framing forms the largest proportion of the total timber market by a significant margin. The remaining nine grades of timber hold significantly smaller proportions of the total timber market. The value of the No. 1 Framing timber market is \$NZ 266 m.

**TABLE 17: TIMBER MARKET DETAILS**

<u>TIMBER GRADE:</u>	<u>MARKET SIZE (M<sup>3</sup> P.A.):</u>	<u>% OF TOTAL:</u>	<u>MARKET VALUE (\$NZ):</u>
No. 1 Framing	493,020	27 %	\$NZ 266 m
Clears	270,326	15 %	n/a
Select A	229,771	13 %	n/a
No. 2 Framing	206,109	11 %	n/a
Merchantable	167,563	9 %	n/a
No.2 Cuttings	145,996	8 %	n/a
No 1 Cuttings	104,106	6 %	n/a
Select B	101,417	6 %	n/a
Dressing	76,699	4 %	n/a
Engineering	29,993	2 %	n/a
Total Domestic Mkt	1,825,000	100 %	n/a
Total Export Mkt	938,000	n/a	n/a
Total Mkt Size	2,763,000	n/a	

Note 1: Based on December 1994 prices of No. 1 Framing at \$ 540 m<sup>3</sup>.

The most common size which No. 1 Framing is traded is 100 x 50. The percentage of each length category of the average contract trading 100 x 50 No. 1 Framing timber is shown in Table 18.

**TABLE 18: PERCENTAGE OF EACH LENGTH CATEGORY OF THE AVERAGE CONTRACT TRADING 100 x 50 No. 1 FRAMING TIMBER**

<i>Length Category (m)</i>	<i>Percentage in Length Category</i>
1.80	0.07 %
2.10	0.07 %
2.40	0.21 %
2.70	0.17 %
3.00	0.21 %
3.30	0.17 %
3.60	19.22 %
3.90	0.16 %
4.20	0.97 %
4.50	0.14 %
4.80	76.34 %
5.10	0.16 %
5.40	1.23 %
5.70	0.16 %
6.00	0.72 %
	100.00 %

These results show that 100 x 50 No. 1 Framing timber is largely sold in just two length categories — 3.6 m and 4.8 m. It appears that it would be appropriate to adopt a

scheme consistent with the log trading markets which allows a percentage in each length category. The scheme detailed in Table 19 would suit the results of the survey.

**TABLE 19: PERCENTAGE ALLOWED FOR A CONTRACT TRADING 100 x 50 No. 1 FRAMING TIMBER WHICH SUITS THE CURRENT MARKETING PRACTICES OF THE INDUSTRY**

<i>Length Category (m)</i>	<i>Percentage Allowed in Length Category</i>
3.60 m	20 % Maximum
3.90 — 4.50 m	5 % Balance
4.80 m	75 % Minimum

The average contract trading No. 1 Framing is for 14.93 m<sup>3</sup>.

#### 4.3.5 Conclusion

The most common export log is Japanese — A grade, and it is estimated that 2,976,160 m<sup>3</sup> (or 70 % of total export log market) is exported annually. This export grade market is worth \$NZ 622 m and this makes it the largest export log market by both quantity and value. The underlying market of a futures contract based on this grade would be worth \$NZ 1,037 million (without the inclusion of stumpage and forestry market secondary sales). The CME use a minimum threshold size for new markets of \$US 800 million, so the underlying market size is slightly smaller than what they would require. Japanese — A grade logs are sold in size categories very much the same as those detailed in Part IV, and the average contract size is between 3,000 m<sup>3</sup> and 5,000 m<sup>3</sup>.

For the domestic log market, the most common markets were assessed using both the theoretical situation and information from the survey. The combined domestic grades L1/L2 should theoretically form the largest markets by volume, trading an estimated 4,149,000 m<sup>3</sup> and P1/P2 logs trading 3,227,000 m<sup>3</sup>. However, by theoretical value the order reverses because of the difference in log values. Theoretically, the P1/P2 market size should be \$ 419 m annually whereas the L1/L2 market size is only \$ 369 m p.a. The rankings from the survey information remained the same as the theoretical situation, but the size of the markets differs from that expected. Although the combined most common domestic log grades are L1/L2, the market is estimated at 3,581,130 m<sup>3</sup>, and for the P1/P2 grades it is estimated that 3,395,142 m<sup>3</sup> is sold. The

combined P1/P2 markets are worth \$NZ 441 m which makes them the largest markets by value, although the second largest by volume. The combined L1/L2 markets are the second largest by value, and are worth \$NZ 319 market. The percentage of each length class was established in the survey. P1/P2 contracts trade on average 6,743 m<sup>3</sup> and L1/L2 contracts trade on average 4,998 m<sup>3</sup>.

The most common domestic timber grade is No. 1 Framing, and 493,020 m<sup>3</sup> of this grade is sold. The value of this market is \$NZ 266 m. The most common size traded is 100 x 50. It appears, that it would be appropriate to adopt a scheme consistent with the log trading markets which allows a percentage in each length category.

Based on these results it would appear that the largest of the two log markets and the timber market is the export market for Japanese — A grade log. This is the largest by both volume and value. As the price series for this log grade also has the best correlation with other logs and timber, it should be used as the deliverable grade for the best chance of a successful futures contract.

#### **4.4 Liquidity Estimation**

Keynes once observed that while most of us could surely agree that Queen Victoria was a happier woman but a less successful monarch than Queen Elizabeth I, we would be hard put to restate that notion in precise mathematical terms. Keynes' observation could apply with equal force to the notion of market liquidity.

Grossman and Miller (1988, p. 617)

The quotation correctly identifies the subjective nature of assessing market liquidity. Determining the size of the potential market is very difficult because it depends on many factors and assumptions, as considered in Parts II and III.

However, given the size of the physical market, it is possible to guesstimate the size of the futures market by using the U.S. Lumber Futures Contract and underlying market as a proxy, and adjusting for the difference in speculation interest and contract size.

Based on the market sizes detailed in Table 9, the combined underlying market of logs and timber in New Zealand is 18,601,000 m<sup>3</sup>.<sup>61</sup>

The underlying market of the U.S. Lumber Futures Contract is the market for Random Lengths. 43,976 m bd ft of Random Length Lumber was produced in 1991 (United States, National Lumber Manufacturers' Association, 1994). That same year, 160,521 futures contracts were traded (CME). Each of these contracts represents 160,000 bd ft (equivalent to 378 m<sup>3</sup>) of Random Length Lumber. The annual trading of lumber futures, therefore, represents approximately 25,683 m bd ft which is equivalent to 58 %<sup>62</sup> of the size of the underlying market. This can be separated into hedging and speculating trading. 90 % of the trading is estimated to be speculative (CME), which means annual trading of lumber futures by speculators therefore represents approximately 23,115 m bd ft<sup>63</sup> which is equivalent to 53 %<sup>64</sup> of the size of the underlying market. 10 % is hedging, which represents approximately 2,568 m bd ft<sup>65</sup> which is equivalent to 6 %<sup>66</sup> of the size of the underlying market.

The size of the average contract trading Japanese — A grade logs is between 3,000 m<sup>3</sup> to 5,000 m<sup>3</sup>, and this could be used to base the futures contract unit size on. However, the monetary value of a contract with this unit size would be too large. Assuming Japanese — A grade logs currently sell for \$NZ 209 m<sup>3</sup>, one contract would be worth between \$NZ 627,000 and \$NZ 1,045,000. Further, the U.S. Lumber Futures Contract unit size is substantially less, representing just 378 m<sup>3</sup>.

The alternative to basing a futures contract unit size on the size of contracts in the underlying market, is to use the quantity in which the commodity is normally transported. One truck load of Japanese — A grade logs equates to 28 - 30 m<sup>3</sup>. This

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61 15,838,000 plus 2,763,000 is equal to 18,601,000.

62 25,683 divided by 43,976 is equal to 58 %.

63 90 % of 25,683 is equal to 23,115.

64 23,115 divided by 43,976 is equal to 53 %.

65 10 % of 25,683 is equal to 2,568.

66 2,568 divided by 43,976 is equal to 6 %.



and this would appear to be a more suitable unit size as it would equate to a contract worth approximately \$NZ 6,270.

Using this information, market liquidity can be estimated using two different sets of assumptions.

*Scenario One: Assuming that a New Zealand market would have the same level of speculation and hedging interest as the U.S. Lumber Futures market.*

If the same total level of futures trading as is in the U.S. is applied to the New Zealand situation, then 58 % of the underlying market would be equivalent to the size of the futures market. This would give an estimated futures market size of 10,788,580 m<sup>3</sup> p.a.<sup>67</sup> Assuming a contract unit size of 30 m<sup>3</sup>, then liquidity in the New Zealand log futures market would then be 359,619 contracts per annum,<sup>68</sup> or around 1,438 contracts per day. The largest trading contract in New Zealand trades 2,000 and the smallest trading contract trades on average less than 20.

*Scenario Two: Assuming that a New Zealand log futures market would have the same level of speculation and hedging as other New Zealand futures markets.*

If the same level of hedging demand in the U.S. is applied to the New Zealand situation, then 6 % of the underlying market would be equivalent to the size of the hedging demand in a New Zealand futures market. This would give an estimated amount of hedging trading of 1,116,060 m<sup>3</sup> p.a.

The speculation interest of the average New Zealand futures contract is then added to the hedging interest to give the total futures market size. Speculation interest is normally 60 % and hedging interest is normally 40 % in New Zealand, so the proportion of speculation trading is estimated at 1,116,060 m<sup>3</sup> p.a. The total market size would therefore be, 2,790,150 m<sup>3</sup> p.a.

Again, if the contract size was 30 m<sup>3</sup>, then the liquidity of the New Zealand market would be 93,005 contracts per annum, or around 372 contracts per day.

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<sup>67</sup> 58 % of 18,601,000 is equal to 10,788,580.

<sup>68</sup> 10,788,580 divided by 30 is equal to 359,619.

In both these scenarios the futures contract appears to be viable.

#### **4.5 The U.S. Lumber Futures Contract as an Alternative to Developing a New Contract in New Zealand**

Three quarters of the world's futures and options business is traded in Chicago, and the three local exchanges are keen to preserve their market share against the growth of international futures and options which has produced both new contracts and new exchanges. As these markets have the benefit of large levels of liquidity, the possibility of dual trading the U.S. Lumber Futures Contract could solve low liquidity problems and therefore have significant benefits over developing a new contract. Trading the contract in New Zealand would also have significant benefits for Chicago. In addition to the extra trading it would bring, the NZFOE has the benefit of being the first exchange open for trading each day, (although CBT is considering moving to 24 hour trading). This means that the exchange would be at the forefront of the Pacific Basin trading in lumber futures.

Although there are many complicated access and regulation problems to solve, the NZFOE's Articles of Association allows dual trading, and the exchange can easily adjust its trading times to allow the contract to be traded simultaneously in Chicago and New Zealand.

Proliferation of the U.S. contract by the NZFOE is also possible. However, experience seems to suggest that multiple futures markets for the same commodity are rarely successful. One market usually dominates trading very quickly, and other markets seem to die from lack of liquidity (Goss and Yamey, 1976).

The major factor influencing successful dual trading, or contract proliferation, is the issue of correlating price movements. If prices of U.S. Lumber correlate well with New Zealand forestry market price series, then there is no need to develop a new contract in New Zealand, because price risk incurred in New Zealand could be hedged against using the U.S. Lumber Futures Contract. To test if there are any such hedging benefits, a correlation analysis between the price series of all the New Zealand Forestry markets, and both the U.S. Random Lengths and U.S. Lumber Futures Contract, was completed.

The results of the correlation analysis are shown in Table 20. The correlation coefficient in nearly all cases is small and negative. Therefore no hedging benefits can be derived by trading the U.S. Lumber Futures Contract to avoid price risk in New Zealand forestry sub-markets.

**TABLE 20: CORRELATION BETWEEN THE NEW ZEALAND FORESTRY SUB-MARKETS AND BOTH THE U.S. RANDOM LENGTHS AND U.S. LUMBER FUTURES CONTRACTS**

	RANDOM LENGTHS	NOV 94 FUTURES
Japan - A Log Prices	-0.33	-0.30
Japan - J Log Prices	-0.32	-0.30
Korean - K Log Prices	-0.47	-0.31
Total Log Price Index	-0.58	-0.61
Japan's Comp. of Log	-0.48	-0.55
Korea's Comp. of Log	-0.52	-0.65
Total Timber Price Index	-0.26	-0.32
Japan's Comp. of Tim.	-0.22	-0.37
Aust.'s Comp. of Tim.	-0.05	0.21
Total Exports Index	-0.66	-0.69
Wood Index	-0.53	-0.57
Pulp Index	-0.72	-0.65
Wood Manufacture Index	0.40	0.27
Paper and Paper Products Index	-0.27	-0.21
Forestry Products	-0.65	-0.69
Random Lengths	1.00	0.88
Nov 94 Futures	0.88	1.00

#### **4.6 Conclusion**

The price series for Japanese — A grade logs has the highest overall correlation with other price series for logs and timber, and a physical market on this log grade would include:

- the secondary market for forestry sales,
- the stumpage market,
- the entire log market, although this is essentially export market, and
- the timber market except Australian timber.

The most common export log is also Japanese — A grade, and it is estimated that 2,976,160 m<sup>3</sup> (or 70 % of total export log market) is exported annually. This export grade market is worth \$NZ 622 m and this makes it the largest export log market by both quantity and value. As Japanese — A grade logs have the best correlation with

other logs and timber, and are the most common export log, they should be used as the deliverable grade for the most likely successful futures contract. The underlying market of a futures contract based on this grade would be worth \$NZ 1,037 million (without the inclusion of stumpage and forestry market secondary sales). Japanese — A grade logs are sold in the size categories very much the same as those detailed in Part IV, and the average contract size is between 3,000 m<sup>3</sup> and 5,000 m<sup>3</sup>.

Liquidity estimation is very subjective, but given the size of the physical market, it is possible to guesstimate the size of the futures market using the U.S. Lumber Futures Contract and underlying market as a proxy and adjusting for the difference in speculation interest and contract size. Assuming the same level of speculation as the U.S. Lumber Futures Contract and a contract size of 30 m<sup>3</sup>, it is estimated that around 1,438 contracts would be traded per day. Assuming the same level of speculation as other New Zealand based contracts, around 372 contracts are estimated to be traded per day. Under both these scenarios the liquidity for the futures contract appears to be very good by New Zealand standards.

Because the U.S. Lumber Futures Contract is already running successfully, the possibility of using that contract to avoid price risk in New Zealand was assessed. However, unfortunately no hedging benefits can be derived by trading the U.S. Lumber Futures Contract to avoid price risk in New Zealand forestry sub-markets.

## **5. Competitively Determined Prices**

### **5.1 Introduction**

For a successful futures market, the underlying commodity must flow naturally to a competitive and unregulated market with low delivery and transaction costs. The price must be determined only by competitive supply and demand forces so the market must be free from control by government, cartel or monopolist. Low delivery and transaction costs are important so that any derivation in the futures and cash price will be arbitrated away by the continuous and orderly meeting of supply and demand forces. This allows the futures and cash market prices to converge on settlement which increases the hedging benefit.

Although speculative profits and losses are derived from price fluctuations, speculative demand also stems from good information flow, because speculators believe that they can process this information in a superior fashion, which allows them to forecast prices and ultimately derive profits.

## **5.2 Test of Random Fluctuation**

### **5.2.1 Introduction**

Good information flow and competitive determined prices in the physical market may be measured by testing for random fluctuation.

### **5.2.2 Method**

For each price series considered in the above analyses, the variance ratio  $VR(q)$  and the variance ratio statistic  $Z_2^*(q)$  were used to test for random fluctuation under a method developed by Lo and MacKinlay (1988). This test exploits the fact that the variance of increments in random fluctuation are linear in a sampling interval. That is, if a price series fluctuates randomly, the variance of its  $q$ th differences would be  $q$  times the variance of its first differences. Therefore, for  $nq + 1$  price series observations  $S_0, S_1, S_2, \dots, S_{nq}$  at equally spaced intervals ( $q$  is any integer greater than one), the ratio of  $1/q$  of the variance  $S_t - S_{t-q}$  to the variance of  $S_t - S_{t-1}$  would be equal to one. Simply stated then, the variance ratio  $VR(q)$  is computed by dividing the variance of price changes estimated from the longer time interval by the variance of changes from the shorter interval, and if the ratio is equal to one the price series fluctuates randomly. The variance ratio and variance ratio statistic was calculated for length periods of  $q = 2$  to  $q = 12$ . (Liu and He, 1991).<sup>69</sup>

$$VR(q) = \frac{\sigma_c^2(q)}{\sigma_a^2(q)} - 1 \quad (1)$$

In equation (1) the numerator is an unbiased estimator of  $1/q$  of the variance of the  $q$ th price series change (change over a period of length  $q$  periods). The denominator is

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<sup>69</sup> In Lo and MacKinlay (1988) a typographical error was made in the numerator of the formula for  $Z^*(q)$ . This error (the mistaken inclusion of the factor,  $\sqrt{nq}$ ) has been remedied in equation (6) below.

an unbiased estimator of the variance of price changes over a single period. The multiplier  $1/q$  normalises the ratio to one, because it effectively divides the variance ratio by the ratio of the longer interval by the shorter interval. The numerator of equation (1) was calculated as follows:

$$\sigma_c^2(q) = \frac{1}{m} \sum_{k=q}^{nq} \left( X_k - X_{k-q} - q\hat{\mu} \right)^2 \quad (2)$$

In equation (2) the multiplier,  $1/m$ , is calculated from:

$$m = q(nq - q + 1) \left( 1 - \frac{q}{nq} \right) \quad (3)$$

And the denominator of (1) is:

$$\sigma_a^2(q) = \frac{1}{nq-1} \sum_{k=1}^{nq} \left( X_k - X_{k-1} - \hat{\mu} \right)^2 \quad (4)$$

The sample mean,  $\hat{\mu}$  is calculated as follows:

$$\hat{\mu} = \frac{1}{nq} (X_{nq} - X_0) \quad (5)$$

After deriving an asymptotic distribution of the variance-ratio, the heteroscedasticity-consistent standard normal test statistic  $Z^*(q)$  is developed by comparing the sample variance-ratio with the asymptotic variance of this variance-ratio.  $Z^*(q)$ , therefore, provides an asymptotic standard normal test statistic for the variance ratio  $VR(q)$  of the price series. The heteroscedasticity-consistent standard normal test statistic  $Z^*(q)$  is:

$$Z_2^*(q) = \frac{VR(q)}{\sqrt{\phi^*(q)}} \quad (6)$$

The denominator of (6) containing the heteroscedasticity-consistent asymptotic variance of the variance-ratio,  $\phi^*(q)$ , is calculated as follows:

$$\phi^* = \sum_{j=1}^{q-1} \left[ \frac{2(q-j)}{q} \right]^2 \hat{\delta}(j) \quad (7)$$

Where:

$$\hat{\delta}(j) = \frac{\sum_{k=j+1}^{nq} (X_k - X_{k-1} - \hat{\mu})(X_{k-j} - X_{k-j-1} - \hat{\mu})^2}{\left[ \sum_{k=1}^{nq} (X_k - X_{k-1} - \hat{\mu})^2 \right]^2} \quad (8)$$

It should be noted that the variance ratios have had the integer 1 added back into them so that they centre on unity, as required of the test statistic  $Z_2^*(q)$ .

This method is an extremely powerful test, and it was shown by Lo and MacKinlay (1988) that under heteroscedastic random fluctuation, that it is more reliable than the Box-Pierce Q test which has often been used to test for random fluctuation in the past.

### 5.2.3 Results

The test statistic can be interrupted using criteria defined by Liu and He (1991). If the variance ratio test statistic  $Z_2^*(q)$  is less than 2, the price series is said to fluctuate randomly and is therefore totally competitively determined — information flows freely. If it lies in the interval between 2 and 4, the price series is still said to fluctuate freely and be competitively determined, but to a lesser degree — information flows freely, but more slowly.

Table 21 shows the results of the test. Essentially, prices in both the log and timber markets are competitively determined, as prices fluctuate freely. Information about these markets therefore flows freely.

The timber markets are the most competitive, and have the best information flow, as the test statistics in all cases are less than 2. The price series representing the total

log market are also competitive, and have good information flow as the test statistics in all cases are less than 2. However, the price series for the components of the Japanese log market, Japan — A and Japan — J grade of log, are less competitive than the other series as the test statistics are between 2 and 4. But they are still competitive, and have good information flow.

**TABLE 21: TEST RESULTS OF RANDOM FLUCTUATION**

<i>q</i>	2.00	4.00	6.00	8.00	10.00	12.00
<b>Logs</b>						
<i>Japan - A Log Prices</i>						
VR(q)	1.35	1.77	2.08	2.25	2.19	1.94
Z2*(q)	(2.14)	(2.62)	(2.96)	(2.98)	(2.54)	(1.83)
<i>Japan - J Log Prices</i>						
VR(q)	1.61	2.83	3.84	4.91	5.79	6.10
Z2*(q)	(1.30)	(2.61)	(3.65)	(4.79)	(5.70)	(5.96)
<i>Korean - K Log Prices</i>						
VR(q)	1.20	1.52	0.70	0.06 Not relevant because		
Z2*(q)	(1.55)	(1.57)	(-0.58)	(-1.52) of Limited data size.		
<i>Total Log Index</i>						
VR(q)	1.42	1.47	1.29	1.23	0.94	0.50
Z2*(q)	(1.74)	(0.90)	(0.44)	(0.29)	(-0.07)	(-0.57)
<i>Japan's Comp. of Log</i>						
VR(q)	1.49	1.62	1.54	1.50	1.09	0.61
Z2*(q)	(1.81)	(1.18)	(0.81)	(0.67)	(0.10)	(-0.45)
<i>Korea's Comp. of Log</i>						
VR(q)	1.57	1.44	1.20	1.14	1.02	0.76
Z2*(q)	(2.01)	(0.83)	(0.30)	(0.19)	(0.02)	(-0.28)
<b>Timber</b>						
<i>Total Timber Index</i>						
VR(q)	1.39	1.26	1.11	1.18	1.19	1.25
Z2*(q)	(1.42)	(0.55)	(0.20)	(0.28)	(0.27)	(0.35)
<i>Japan's Comp. Of Timber</i>						
VR(q)	1.48	1.06	0.79	0.81	0.68	0.82
Z2*(q)	(1.87)	(0.13)	(-0.35)	(-0.28)	(-0.43)	(-0.23)
<i>Australia's Comp. Of Timber</i>						
VR(q)	1.19	1.43	1.49	1.33	1.52	1.66
Z2*(q)	(0.69)	(0.95)	(0.90)	(0.54)	(0.77)	(0.91)

#### 5.2.4 Conclusion

All the price series examined fluctuate freely and are competitively determined. Information flows freely about these markets. The markets for the two grades of Japanese logs are, however, not as competitive as the other markets.



### **5.3 Preventing Manipulation**

Preventing manipulation is important, because traders will not use a contract if there is a real possibility of substantial manipulation. Some markets are very unconcentrated and there is no cause for concern. However, in concentrated markets, it is necessary to design a contract that is difficult to abuse. Therefore, the total market and the market for the deliverable grade should be assessed for market concentration.

A contract based on logs is less likely to be manipulated than one based on timber, for two reasons. Firstly, the problem of manipulation normally arises when the deliverable commodity is in short supply. The deliverable commodity of Japan — A grade logs is of a larger volume and value than any other log or timber grade market by a considerable margin. Secondly, the hedging demand indicated by participants in the log market was 64 % from suppliers and 68 % from purchasers. Hence there is a negligible difference in demand between the two sides of the market.

The possibility of manipulation could be reduced by allowing two or more log grades to be delivered together and therefore expanding the size of the deliverable market. However, this is traded off with lower hedging benefits, and there are two strong arguments against expanding the deliverable market. First, trading two or more varieties of logs in one contract is not common marketing practice. Second, this would make futures pricing far more difficult for hedgers who are already likely to need significant education on futures trading.

#### **5.3.1 Assessment of Market Concentration**

The New Zealand Commerce Commission uses a number of different statistics to assess market concentration in determining market dominance under the *Commerce Act 1986*. Some of these statistical measures were applied to the New Zealand forestry industry at the time the state owned forests were for sale to assess what the concentration levels would be if certain sales went ahead. These statistical measures can be applied to assess the market concentration of those producing the deliverable commodity of Japanese — A grade logs and the total market for logs.

There are two main measures used:

- Two-firm concentration ratio, and
- Herfindahl-Hirschman Index (HHI).

The two-firm concentration ratio is simple to develop, as it merely involves the addition of the market shares of the two largest firms in the industry. The HHI index is a more sophisticated measure as it is sensitive to both the relative size and number of firms in the market. The index is calculated by summing the squares of the market shares of all the firms included in the market. For example, a market with four firms, each possessing a 25 % share, would have an HHI of 2,500 (that is,  $(25)^2 + (25)^2 + (25)^2 + (25)^2 = 2,500$ ). The HHI reaches its maximum value of 10,000 at the theoretical case of pure monopoly ( $100^2$ ), and attains a value very close to zero in perfectly competitive markets.<sup>70</sup>

**TABLE 22: CONCENTRATION STATISTICS FOR THE SUB-MARKET OF JAPANESE — A GRADE LOGS AND THE TOTAL LOG MARKET**

<i>Concentration Statistic</i>	<i>Japanese — A Grade Market</i>	<i>Total Log Market</i>
Two-firm concentration ratio	61 %	40 %
Herfindahl-Hirschman Index (HHI)	2,454	1,050

The results of the concentration statistics are detailed in Table 22. Unfortunately, there are no general guidelines available for comparison with particular respect to the futures industry. However, the Futures Trading Commission in the U.S. have allowed trading to proceed in the Cheddar Cheese contract listed on the Coffee, Sugar, and Cocoa Exchange (CSCE) in New York recently even although Kraft, which is the largest firm in the industry, has a 60 % share of the underlying market (CSCE, Verbal comment, 1994). Using this as a guideline, the total log market, and the market for Japanese — A grade logs, is not concentrated to a degree which would create a problem for successful futures trading. The total log market is reasonably unconcentrated, and

<sup>70</sup> The variables used to represent market shares are revenues, unit sales, or capacity.

the market for Japanese — A grade logs, although more concentrated, is less concentrated than the Cheddar cheese market.<sup>71</sup>

#### **5.4 Conclusion**

The price series examined all fluctuate freely and are competitively determined, therefore information flows freely in these markets. The markets for the two grades of Japanese logs, however, are not as competitive as the other markets. Manipulation is unlikely to be a problem for a futures contract based on Japanese — A grade logs because the concentration of the market is less than that of a successful contract in the U.S., which is more concentrated.

### **6. Homogenous Product**

As stated in Part III, the feasibility element of homogeneity has changed considerably over time. It is important for futures contract specifications to state a standardised description so that buyers and sellers know with certainty what they are required to deliver or receive. But the asset described need not be a totally homogeneous commodity. It is only necessary that the asset is able to be scientifically described, in well-defined guidelines, so that the units of the asset may be traded on the basis of physical description — “sight unseen”.

The homogeneity element has been one of the major problems of futures contracts for forest products in other countries because of the many species, types of commodities, grades, and sizes. In the survey, several respondents mentioned the potential problem:

... logs are too heterogeneous and grades cannot be defined with sufficient precision ...

Although both logs and timber are somewhat heterogeneous, they are able to be scientifically described, in well defined guidelines, so that the units of the asset may be traded “sight unseen”. This is the normal marketing method for most export grade logs and timber. For example, an exporter can unload logs at a marshal’s wharf-side office,

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71 The market for Japanese — A grade logs must be less concentrated than the Cheddar Cheese market, because the Two-firm concentration ratio of 61 % is equal to the market share of Kraft, and the HHI in the Cheddar Cheese market must be greater than 3,600.

where they will be scientifically categorised and placed in piles with logs of the same grade. The marshal then organises the loading of these piles of logs of the same grade onto the ship when it arrives, and charges the exporter for these services. The purchaser buys the logs “sight unseen”.

## **7. Delivery Costs and Similarity to Current Marketing Practices**

An export log based futures contract, deliverable at wharf gate, could be structured so that no costs, additional to normal marketing costs, are incurred. Delivery could be made by the same method as normal marketing. The log marshal could be contracted by the Clearing House to accept and grade logs shortly after the final trading day. As with normal log marketing, the marshal could still charge the seller for the grading service. With in a short time, the purchaser could then either remove the logs from the marshal’s premises, or instruct the marshal to sell them overseas by the normal method. The seller would be charged for the costs of loading and marketing the logs if these services are provided. This system would incur no expense additional to the cost of normal marketing. It would simply involve a split of the total marketing cost. Grading and storing costs would be incurred by the seller, and marketing, loading and international marketing would be incurred by the purchaser. A log marshal at The Port of Tauranga has preliminarily agreed that they could provide this service for the clearing house.

Domestic log and sawn timber markets are however very different because neither of these markets is formalised and the commodities do not flow through a single market place. Sales are normally negotiated directly between the parties concerned and the terms of the contract, including delivery provisions, are made to suit the parties. As such, a new delivery location would be required. If this was set up, each delivery and acceptance would incur transportation costs to and from this location. As logs and sawn timber are large and heavy, transportation costs could be huge, thus outweighing the benefits of participating in the market. A contract based on a “call on production” cannot solve this problem because the transportation costs will still be incurred between the buyer’s and seller’s location, and neither trader will be willing to incur this cost when they do not know exactly what it may be.

## **8. Product Storability**

Both logs and timber are capable of being stored for short periods of time. However, logs begin to deteriorate by rooting after three months in wet or damp conditions and after six months in dry clean conditions. A substantial proportion of timber is “treated” which allows it to be stored for long periods of time in suitable conditions. However, “untreated” timber will begin to root, or deteriorate by warping and splitting, in just six months in normal outdoor storage conditions.

## **9. Preferred Delivery Unit**

The preliminary investigation indicated that the industry preferred a deliverable contract to an index based one. This result was confirmed by the survey results. By market share, only 3 % of the respondents dealing in logs and only 30 % dealing in timber preferred an index based contract and only 30 % dealing in timber.

The most preferred delivery option was a market based price determined by actual delivery of the most common grade of export log. By market share, 36 % of those dealing in logs and 25 % of those dealing in timber preferred this option.

## **10. Settlement Months**

Settlement months are a necessary part of contract specifications, and are usually established with respect to harvest, output, or times of demand. However, the results of the survey indicated that respondents had no particular preference for settlement months and the flow of logs and timber was steady all year round.

The survey also asked how far in advance the capacity to hedge, and knowledge of forward prices, would be useful for the industry. This information was used to devise the length of time for which the contract should be quoted out to.

Table 23 shows the results, which indicate that the majority of the risk is short term. Approximately 95 % of both the log and timber markets indicated that a futures contract needs to be quoted out to no longer than nine months.

**TABLE 23: DESIRED QUOTATION LENGTH BY PERCENTAGE OF MARKET SHARE**

<i>Contract Should be Quoted To:</i>	<i>Log Market</i>	<i>Timber Market</i>
One Month	0 %	1 %
Three Months	24 %	21 %
Six Months	55 %	64 %
Nine Months	16 %	9 %
Fifteen Months	2 %	5 %
Twenty Four Months	3 %	1 %

## **11. Margins**

Margins are determined against volatility and contract value, and are reviewed regularly as volatility changes. The largest price fluctuation that has occurred in any one month period during the time that a price series has been available for Japanese — A grade logs is 12.38 %. If the contract size is set at 30 m<sup>3</sup>, the current contract value is around \$NZ 6,270, assuming a log price of \$NZ 209 m<sup>3</sup>. Therefore, an appropriate margin for a contract of this value based on maximum historical volatility would be \$NZ 776.

## **12. Conclusion**

The objective of Part V was to determine the feasibility and likelihood of success of a futures market based on logs or timber.

The level of volatility in New Zealand log and timber price series was examined graphically and using statistical measures, and was compared against the volatility of the U.S. Random Lengths and Plywood markets. The level of volatility in the log and timber markets appeared statistically compatible with the same measure for the U.S. Random Lengths Lumber and Plywood markets at the time futures contracts were being considered, and also at present.

Because no level of price volatility can guarantee hedging demand *per se*, participants of the log and timber markets were asked whether fluctuating prices and/or the lack of forward price information was a problem. 42 respondents (78 %) indicated that it was. By market share, 64 % of respondents who supply logs and 68 % who purchase logs indicated that it was a problem. In the timber market, 77 % of

respondents who supply timber and 48 % who purchase timber indicated that it was a problem for them.

The U.S. Lumber Futures Contract was assessed for hedging and forecasting ability, and this contract appears to be successful in both these respects. These roles of the futures market appear to be very well known by respondents in the various markets.

To assess the hedging demand for a contract, those respondents who indicated that they understood the role of the futures market in hedging and forecasting were asked if they thought a futures market would be useful for their industry, such that they would use it. By market share, 60 % of respondents who supply logs and 61 % who purchase logs indicated that they thought a futures market would be useful and that they would use a contract. In the timber market, 71 % of respondents who supply timber and 33 % who purchase timber also indicated that they thought a futures market would be useful and that they would use a contract.

It is difficult to estimate speculation demand on the NZFOE, but using figures from the SFE and CME it is estimated that 40 % of current trading in New Zealand is speculative.

The price series for Japanese — A grade logs has the highest overall correlation with other price series for logs and timber, and a physical market on this log grade would include:

- the secondary market for forestry sales,
- the stumpage market,
- the entire log market, although this is essentially export market, and
- the timber market except Australian timber.

The most common export log is also Japanese — A grade, and it is estimated that 2,976,160 m<sup>3</sup> (or 70 % of total export log market) are exported annually. This export grade market is worth \$NZ 622 m.

As Japanese — A grade logs have the best correlation with other logs and timber, and are the most common export logs, they should be used as the deliverable grade for the most likely successful futures contract. The underlying market of a futures contract

based on this grade would be worth \$NZ 1,037 million (without the inclusion of stumpage and forestry market secondary sales).

Liquidity estimation is very subjective, but given the size of the physical market, it is possible to guesstimate the size of the futures market using the U.S. Lumber Futures Contract and underlying market as a proxy, and adjusting for the difference in speculation interest and contract size. Assuming the same level of speculation as the U.S. Lumber Futures Contract and a contract size of 30 m<sup>3</sup>, it is estimated that around 1,438 contracts would be traded per day. Assuming the same level of speculation as other New Zealand based contracts, around 372 contracts are estimated to be traded per day. Under both these scenarios the level of liquidity is compatible to other New Zealand futures markets.

Because the U.S. Lumber Futures Contract is already running successfully, the possibility of using that contract to avoid price risk in New Zealand was assessed. Unfortunately, however no hedging benefits can be derived by trading the U.S. Lumber Futures Contract to avoid price risk in New Zealand forestry sub-markets.

The price series examined all fluctuate freely and are competitively determined, therefore information flows freely in these markets. The markets for the two grades of Japanese logs, however, are not as competitive as the other markets. Manipulation is unlikely to be a problem for a futures contract based on Japanese — A grade logs because the concentration of the market is less than that of a successful contract in the U.S.

Although both logs and timber are somewhat heterogenous, they are able to be scientifically described, in well defined guidelines, so that the units of the asset may be traded by physical description — “sight unseen”. This is the normal marketing method for most export grade logs and timber. Both logs and timber are capable of being stored for short periods of time.

An export log based contract, deliverable at wharf gate, could be structured so that no costs, additional to normal marketing costs, are incurred. Delivery could be made by the same method as normal marketing. However, on either a domestic grade of log or sawn timber delivery costs, could conceivably be very large.



Respondents to the survey preferred a market based export log price as a delivery unit and considered that the contract should be quoted out to nine months.

An appropriate margin for a contract with a unit size  $30 \text{ m}^3$ , based on maximum historical volatility, would be \$NZ 776.

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**PART VI:**  
**CONCLUSIONS, RECOMMENDATION AND**  
**CONTRACT SPECIFICATIONS**

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## 1. Conclusion

Futures markets trade contracts with standardized specifications for the purchase or sale of commodities, or financial instruments, at predetermined delivery dates in the future, at prices agreed upon when the contract is entered. The specifications detail the quality of the underlying asset, unit size, price quotations, minimum fluctuations, contract value, mandatory settlement value, final trading day, settlement method, mandatory settlement price, tick size, initial margin, and settlement months.

Futures markets provide two essential economic roles: *hedging facilities* and *price discovery*. Essentially, the futures market may be considered as a means of risk transfer. As a result of the elimination of price risk, business costs will be more certain. This procures production efficiency, better profitability, improved resource allocation, and ultimately increases social welfare.

However, not all commodity markets have the capacity to support a futures market as factors and conditions which indicate market feasibility do not necessarily ensure success. Therefore, developing a successful futures market is very difficult. A successful commodity futures market requires, *inter alia*: an underlying market on which to base the contract; a degree of price volatility in this market; a product which is capable of being traded on the basis of physical description; a large underlying cash market; and a competitive and unregulated underlying market with freely flowing information. Ultimately, however, the demand for a contract dictates success, and therefore, contract specifications must reflect industry practices to attract hedgers and speculators.

The New Zealand log market satisfies these conditions:

- The size of the New Zealand log market is 15.838 million m<sup>3</sup>, and it will increase in the future. While this market is not formalised, export grade logs must flow through a port.
- The level of volatility in the New Zealand log and timber markets is statistically compatible with the same measure for the U.S. Random Lengths Lumber and Plywood markets at the time futures contracts were

being considered, and also at present. 42 survey respondents (78 %) indicated that fluctuating prices and/or the lack of forward price information was a problem. By market share, 64 % of respondents who supply logs and 68 % who purchase logs indicated that it was a problem, and in the timber market, 77 % of respondents who supply timber and 48 % who purchase timber indicated that it was a problem for them.

There is considerable hedging demand for a contract. By market share, 60 % of respondents who supply logs and 61 % who purchase logs indicated that they thought a futures market would be useful and that they would use a contract. In the timber market, 71 % of respondents who supply timber and 33 % who purchase timber indicated that they thought a futures market would be useful and indicated that they would use a contract.

- A tree yields a composite of joint log products, not a single homogeneous quality of log. However, the joint log products are graded into homogeneous classes for the purpose of sale contracts using scientific methods so that sales may be made on the basis of physical description — “sight unseen”.
- Japanese — A grade logs have the highest correlation with other logs and timber, and are the most common export log. They should, therefore, be used as the deliverable grade for the most likely successful futures contract. 2,976,160 m<sup>3</sup> (or 70 % of total export log market) of Japanese — A grade logs are exported annually. This export grade market is worth \$NZ 622 m. However, the underlying market of a futures contract based on this grade would be worth \$NZ 1,037 m because of logs and timber which could be cross-hedged using the contract (this does not include stumpage and immature forestry sales).

Liquidity estimation is very subjective, but given the size of the underlying market, it is possible to guesstimate the size of the futures market using the U.S. Lumber Futures Contract and underlying market as a proxy while adjusting for the difference in speculation interest and

contract size. Assuming the same level of speculation as the U.S. Lumber Futures Contract and a contract size of 30 m<sup>3</sup>, it is estimated that around 1,438 contracts would be traded per day. Assuming the same level of speculation as other New Zealand based contracts, it is estimated that around 372 contracts would be traded per day. Under both these scenarios the level of liquidity is compatible to other New Zealand futures markets.

- The price series examined all fluctuate freely and are competitively determined, therefore information flows freely in these markets. The markets for the two grades of Japanese logs, however, are not as competitive as the other markets. Manipulation is unlikely to be a problem for a futures contract based on Japanese — A grade logs because the concentration of the market is less than that of a successful contract in the U.S., which is more concentrated.

## **2. Recommendation**

The essential conclusion of this research is that a successful log futures contract is feasible. The basic recommendation is therefore that the NZFOE consider listing a log futures contract reflecting the contract specifications detailed below.

## **3. Contract Specifications for a Log Futures Contract**

### **Commodity Specifications of the Underlying Asset:**

Each delivery unit shall consist of 30 m<sup>3</sup> of Japanese — A grade logs of random length. The logs must be grade and length stamped, “Japanese — A grade”, by an approved log marshall of the clearing house.

Japanese — A grade logs must conform to the following grade and length specifications:

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**LOG SPECIFICATIONS FOR JAPANESE — A GRADE LOG FUTURES CONTRACT**


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<i>S.e.d. (mm)</i>		<i>L.e.d</i>	<i>Max Knot (mm)</i>	<i>Lengths (m)</i>	<i>Percentage Allowed</i>	<i>Sweep</i>
<i>Min.</i>	<i>Ave.</i>	<i>Max.</i>				
200	340	800	1/3 s.e.d up to 150mm max.	4.0	10% max	1/4 s.e.d.
			Excessive number of large	8.0	balance	1/2 s.e.d.
			knots not permitted.	12.0	50% min	s.e.d.

Notes: An excessive number of knots means three or more whirls made up of 5 - 10 cm knots occurring in any 1 metre of a log

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**Unit Size:**

Each delivery unit shall consist of 30 m<sup>3</sup> determined using the Japanese Agricultural Standard (JAS) formula.

The tally of 30 m<sup>3</sup> of Japanese — A grade logs must conform to the following log length requirements:

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**LENGTH REQUIREMENTS FOR JAPANESE — A GRADE LOG FUTURES CONTRACT**


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<i>Length</i>	<i>Percentage Limits of Total m<sup>3</sup> Delivered for Length Each Category</i>
4.0 m	10 % Maximun
8.0 m	Balance
12.0 m	40 %Minimum

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Variations in quantity of the delivery unit between 30 m<sup>3</sup> and 32 m<sup>3</sup> are permitted without penalty, but payment shall be made on the basis of the 30 m<sup>3</sup> delivery unit.

**Price Quotations:**

Prices will be quoted in cents per JAS m<sup>3</sup> and expressed in New Zealand dollars.

**Minimum Fluctuations:**

1 cent.

**Tick Size:**

\$ 30.

**Contract Value:**

The value of the contract will be equal to the price agreed by the parties multiplied by 3,000, and expressed in New Zealand dollars.

**Initial Margin:**

\$ 776.

**Settlement Months:**

Feb/Apr/June/Aug/Oct/Dec. Quoted out to nine months.

**Delivery Procedures:***Notice of intent to deliver*

The seller must give notice of intent to deliver to the clearing house prior to 3.00 pm (New Zealand time) on the final day of trading of the corresponding contract month.

*Delivery procedure*

The seller must deliver the delivery unit to an approved log marshall of the clearing house at a certified delivery point within two days of the closing of trading. Title will pass from the seller to the clearing house at this time. The expenses of grading must be borne by the seller of the logs.

*Payment*

Upon the seller's fulfilment of delivery, the clearing house shall transfer the amount due in respect of the futures contract. Payment shall be made in New Zealand dollars net of government duties, fees and charges.

**Settlement:***Notice of intent to collect*

The buyer must give notice of intent to collect to the clearing house prior to 3.00 pm (New Zealand time) on the final day of trading of the corresponding contract month.

*Collection procedure*

The buyer must collect the delivery unit from the certified delivery point within ten days of the closing of trading. Title will pass from the clearing house to the buyer at this time. (The buyer is, of course, free to instruct the operator of the delivery location to sell the logs at the market rate. Any costs in connection with this will be borne by the seller (inclusive of the costs of storage, except the first ten days)).

*Payment*

Prior to collection being allowed the purchaser must transfer to the clearing house the amount due in respect of the futures contract. Payment shall be accepted only in New Zealand dollars inclusive of government duties, fees and charges.

**Final Trading Day:**

The final trading day will be the second to last business day of the relevant settlement month.

**Delivery Day:**

The seller must deliver the delivery unit to an approved log marshall of the clearing house at a certified delivery point within two days of the closing of trading.

**Settlement Day:**

The buyer must collect the delivery unit from the certified delivery point within ten days of the closing of trading.<sup>72</sup>

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<sup>72</sup> Some specifications detailed are obviously arbitrary and can be determined by the exchange as they see fit in the event that a log contract is listed. The arbitrary specifications detailed here are given only for the purposes of illustration.



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*Philip Wensley*

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## **Appendix One: The Survey**

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### **Sawmills and Exporters Survey for the Development of a Log or Timber Futures Contract**

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1: How many m<sup>3</sup> of logs and timber do you purchase, or sell, in one year?

m <sup>3</sup> p.a. of logs
m <sup>3</sup> p.a. of timber

2: Are you: (Tick for Yes)

a) a supplier of logs?

☐

b) a purchaser of logs?

☐

c) a supplier of timber?

☐

d) a purchaser of timber?

☐

3: Are fluctuating log and/or timber prices, or the lack of forward price information, a problem for your business?

a) Yes

☐

b) No

☐

4: (i) — Are you familiar with how the futures market may be used to hedge against fluctuating prices?

a) Yes

☐

b) No

☐

(ii) — Are you familiar with how the futures market may be used as an indicator of forward prices?

a) Yes

☐

b) No

☐

(iii) — If you answered “yes” to either of the first two parts in this question, do you think a futures market would be useful in your industry, such that you would use it?

a) Yes

☐

b) No

☐

c) Don't know

☐

If you “don't know” whether you would use a futures market, please skip question 5, and go to question 6.

5: Which of the following bases do you consider would be best to base the futures contract on?

a) The Wood Price Index of the Ministry of Forestry

☐

b) A new index, compiled by the Ministry of Forestry, based on the most common export grade of log

☐

c) A new index, compiled by the Ministry of Forestry, based on the most common domestic grade of log

☐

d) A new index, compiled by the Ministry of Forestry, based on the most common grade of timber

☐

e) A market based price determined by actual delivery (possibly at wharf gate) of the most common grade of export log

☐

f) A market based price determined by actual delivery of the most common grade of domestic log

☐

g) A market based price determined by actual delivery of the most common grade of timber

☐



6: How far in advance would the capacity to hedge, and knowledge of a forward price, be most beneficial to you?

- a) One month ☐
- b) Up to three months ☐
- c) Up to six months ☐
- d) Up to nine months ☐
- e) Up to fifteen months ☐
- f) Up to twenty four months ☐

7: In which months of the year would the capacity to hedge, and knowledge of a forward price, be most useful for you?

Rank in order of most useful month (1), to least useful month (12).

January	_____	April	_____	July	_____	October	_____
February	_____	May	_____	August	_____	November	_____
March	_____	June	_____	September	_____	December	_____

8: Is the flow of logs and/or timber, to and from your business, greater in some months?

Rank in order of month with greatest flow (1), to month with least flow (12).

January	_____	April	_____	July	_____	October	_____
February	_____	May	_____	August	_____	November	_____
March	_____	June	_____	September	_____	December	_____

If you only deal in (supply or purchase) timber, skip question 9, 10 and 11, and go to question 12.

9: If you supply logs, what percentage do you:

a) export?

b) sell domestically?

	%
	%

If you only deal in (supply or purchase) domestic logs, skip question 10, and go to question 11.

10: If you export logs of the grades specified in the table below, please enter the percentage of logs sold in the line under each length category. Please also enter the average quantity of logs normally sold in each contract, and then complete the column on the right-hand side to indicate the total percentage sold for each grade.

Log Grade	Log Length and Percentage	% Totals
(i) N Z Radiata Pine — Japan A	Log Length: <u>12 m</u> <u>10 m</u> <u>8 m</u> <u>6 m</u> <u>4 m</u> Percentage: <u>    </u> % <u>    </u> % <u>    </u> % <u>    </u> % <u>    </u> % What average quantity of logs are normally sold in a single Japan A grade contract? <u>                    </u> m <sup>3</sup>	<u>    </u> %
(ii) N Z Radiata Pine — Japan J	Log Length: <u>12 m</u> <u>10 m</u> <u>8 m</u> <u>6 m</u> <u>4 m</u> Percentage: <u>    </u> % <u>    </u> % <u>    </u> % <u>    </u> % <u>    </u> % What average quantity of logs are normally sold in each Japan J grade contract? <u>                    </u> m <sup>3</sup>	<u>    </u> %
(iii) N Z Radiata Pine — Korean K	Log Length: <u>    </u> 11 m <u>    </u> 7.3 m <u>    </u> 5.4 m <u>    </u> 3.6 m Percentage: <u>    </u> % <u>    </u> % <u>    </u> % <u>    </u> % What average quantity of logs are normally sold in each Korean K grade contract? <u>                    </u> m <sup>3</sup>	<u>    </u> %
(iv) N Z Radiata Pine — C	Log Length: <u>    </u> 10 m <u>    </u> 8 m <u>    </u> 6 m <u>    </u> 4 m Percentage: <u>    </u> % <u>    </u> % <u>    </u> % <u>    </u> % What average quantity of logs are normally sold in each C grade contract? <u>                    </u> m <sup>3</sup>	<u>    </u> %
	Total of all log grades:	<u>100</u> %

11: If you deal in (sell or purchase) the domestic grades of log specified in the table below, please enter the percentage of logs bought or sold in the line under each length category. Please also enter the average quantity of logs normally sold in each contract, and then complete the column on the right-hand side to indicate the total percentage sold for each grade.

Log Grade	Log Length and Percentage	Total
(i) N Z Radiata Pine — P1/P2	Log Length: <u>6.0 m</u> <u>5.4 m</u> <u>4.8 m</u> <u>4.2 m</u> <u>3.6 m</u>	
	Percentage: _____ % _____ % _____ % _____ % _____ %	
	What average quantity of logs are normally sold in a single P1/P2 grade contract? _____ m <sup>3</sup>	
(ii) N Z Radiata Pine — S1/S2	Log Length: <u>6.0 m</u> <u>5.4 m</u> <u>4.8 m</u> <u>4.2 m</u> <u>3.6 m</u>	
	Percentage: _____ % _____ % _____ % _____ % _____ %	
	What average quantity of logs are normally sold in each S1/S2 grade contract? _____ m <sup>3</sup>	
(iii) N Z Radiata Pine — L1/L2	Log Length: <u>6.0 m</u> <u>5.4 m</u> <u>4.8 m</u> <u>4.2 m</u> <u>3.6 m</u>	
	Percentage: _____ % _____ % _____ % _____ % _____ %	
	What average quantity of logs are normally sold in each L1/L2 grade contract? _____ m <sup>3</sup>	
(iv) N Z Radiata Pine — S3/L3	Log Length: <u>6.0 m</u> <u>5.4 m</u> <u>4.8 m</u> <u>4.2 m</u> <u>3.6 m</u>	
	Percentage: _____ % _____ % _____ % _____ % _____ %	
	What average quantity of logs are normally sold in each S3/L3 grade contract? _____ m <sup>3</sup>	
Total of all log grades:		100%

If you do not deal in any timber, skip question 12, and go to question 13.

12: If you deal in timber;

(i) — what percentage of your exotic softwood (New Zealand grown and imported) timber dealings are in the following grades? Note (1): these grades relate to Group III of the New Zealand Standard 3631:1988, Timber Grading Rules, Table 1, at page 27. Note (2): the question only relates to Exotic Softwoods (New Zealand grown and imported).

<u>Appearance Grades:</u>		<u>Structural Grades:</u>		<u>Cuttings Grades:</u>	
Clears	%	Engineering	%	No. 1 Cuttings	%
Select A	%	No. 1 Framing	%	No. 2 Cuttings	%
Select B	%	No. 2 Framing	%		
Dressing	%				
Merchantable	%				

(ii) — Please enter the three most common grades of timber that you deal with (e.g. Clears, No. 1 Framing, and No. 2 Framing) in the table below. Next, for each common timber grade, please enter the three most common thicknesses and widths from the list below. Then enter the percentage of timber bought or sold in the slot under each width and thickness, and length category.

#### Common Thicknesses and Widths

25 x 25  
 50 x 40  
 75 x 50  
 75 x 75  
 100 x 50  
 100 x 100  
 100 x 150  
 100 x 200  
 100 x 250  
 100 x 300

Timber Grade:	(a) _____ (eg. Clears)			(b) _____ (eg. Clears)			(c) _____ (eg. Clears)		
Length:	Thickness & Width (mm):			Thickness & Width (mm):			Thickness & Width (mm):		
1.8 m	%	%	%	%	%	%	%	%	%
2.1 m	%	%	%	%	%	%	%	%	%
2.4 m	%	%	%	%	%	%	%	%	%
2.7 m	%	%	%	%	%	%	%	%	%
3.0 m	%	%	%	%	%	%	%	%	%
3.3 m	%	%	%	%	%	%	%	%	%
3.6 m	%	%	%	%	%	%	%	%	%
3.9 m	%	%	%	%	%	%	%	%	%
4.2 m	%	%	%	%	%	%	%	%	%
4.5 m	%	%	%	%	%	%	%	%	%
4.8 m	%	%	%	%	%	%	%	%	%
5.1 m	%	%	%	%	%	%	%	%	%
5.4 m	%	%	%	%	%	%	%	%	%
5.7 m	%	%	%	%	%	%	%	%	%
6.0 m	%	%	%	%	%	%	%	%	%

(iii) — in the average contract you deal in, what is the average quantity of timber?

m<sup>3</sup>

13: Do you have any additional comments that you would like to offer?

Please use the back of this page if you require more room.

## Appendix Two: Survey List

The General Manager  
Able Timber Supplies  
83 May Road  
P.O. Box 57069  
Auckland

The General Manager  
Amida Processing Ltd  
Cnr Chapel & Marsh Streets  
P.O. Box 46  
Tauranga

Wayne Anderson  
Anderson and O'Leary Ltd  
2-6 Airport Road  
Whenuapai

Mr B.R. Gibson  
B.R. Gibson Ltd  
76 Quarantine Rd  
Stoke  
Nelson

M. A. Cowan  
Blue Mountain Lumber Ltd  
Conical Hill  
Private Bag  
Gore

R. Spence  
Bruce Sawmilling Co  
Park Road  
P.O. Box 130  
Milton

G. Bullock  
Bullock & Co Ltd, B.  
23-27 Wilson Street  
P.O. Box 531  
Wanganui

D.W. Oskin  
Carter Holt Harvey Ltd  
640 Great South Road  
Private Bag 92106  
Auckland

The General Manager  
Cashmore Bros Ltd  
Kent Street  
P.O. Box 9077  
Auckland

L.H. Clapham  
Clapham Sawmilling Ltd  
Carrol Street  
P.O. Box 2051  
Wairoa

M. Clayton  
Claymark Industries Ltd  
72 Vaughan Road  
P.O. Box 1796  
Rotorua

L. Cleland  
Clelands Timbers Ltd  
61 Katere Road  
P.O. Box 3240  
New Plymouth

D.I. Cochrane  
Cochrane Sawmills Ltd  
Chertsey Road  
P.O. Box 112  
Methven

J. F. Cowan  
Craigpine Timber Ltd  
Browns Road  
P.O. Box 55  
Winton

The General Manager  
Cypress Sawmill  
Kahikatea Flat Road  
R D 1, Kaukapakapa  
Auckland

The General Manager  
Ernslaw One Limited  
60 Wharf Street  
P.O. Box 13264  
Tauranaga

The General Manager  
Eucqual Sawmills Ltd  
Houto Road  
Private Bag  
Whangarei

K. Gowen  
Fazackerley Ltd, E.H.  
Cloton Road  
P.O. Box 201  
Stratford

M.C. Berwick  
Feilding Timber Co Ltd  
Lethbridge Road  
P.O. Box 139  
Feilding

T.H. Findlater  
Findlater Sawmilling Ltd  
Tussock Creek. R.D. 1  
Post Code 9662  
Winton

The General Manager  
Flight Anderson Ltd  
Waters Avenue  
P.O. Box 295  
Blenheim

The General Manager  
Forestry Corp. of NZ  
32 Pukaki Street  
P.O. Box 1748  
Rotorua

Geoff Smith  
G R Scoble Ltd  
88-90 Main Street  
P.O. Box 40424  
Wellington

K. Parkinson  
Gibson Ltd, B. R.  
Hou Hou  
P.O. Box 206  
Hokitika

A.J. Hedley  
Hedley & Sons Ltd, W.  
Carroll Street  
P.O. Box 160  
Wairoa

The General Manager  
Henry Brown & Co Ltd  
9 Morley Street  
P.O. Box 400  
New Plymouth

R.D. Hollows  
Hollows Timber Co Ltd  
Kakapuaka Road  
P.O. Box 195  
Balclutha

The General Manager  
Hunter Laminates Ltd  
48 Beach Road  
P.O. Box 3050  
Nelson

The General Manager  
Hurst Timber Ltd  
Ruffel Road  
P.O. Box 25  
Hamilton

L.T. Stuart  
Inangahua Sawmilling Co Ltd  
12 Dick Street  
Post Code 7853  
Reefton

The General Manager  
Itochu NZ Ltd  
Queen Street  
Private Bag 92160  
Auckland

The General Manager  
ITT Rayonier NZ Ltd  
49 Symonds Street  
P.O. Box 9283  
Auckland

The General Manager  
J L Lennard Ltd  
Meachen Street  
P.O. Box 38548  
Wellington

The General Manager  
John Crean & Co Ltd  
210 Te Ngae Road  
P.O. Box 1001  
Rotorua

B.J. Morris  
Kaihu Valley Sawmill  
40-42 Normanby Street  
Post Code 0300  
Dargaville

The General Manager  
Kaimata Sawmills Ltd  
Junction Road  
R D 7  
Inglewood

A.D. Tanner  
Kaitaia Timber Co Ltd  
Pukepoto Road  
P.O. Box 62  
Kaitaia

T. Tinomana  
Karamea Sawmilling Co Ltd  
Oparara Road  
P.O. Box 262  
Westport

A.W. Smart  
Keighley & Co Ltd, W.W.  
Wrights Road  
R D 1  
Kaipoi 8252

P. Anisy  
Keighleys Stillwater Ltd  
Main Highway  
P.O. Box 263  
Greymouth

The General Manager  
L M Rankine Trading Co Ltd  
6 Lipman Street  
P.O. Box 1761  
Wellington

The General Manager  
Mamaku Sawmilling Co Ltd  
Mamaku Street  
P.O. Box 344  
Rotorua

A.F. Davidson  
McAlpines (Rangiora) Ltd  
Southbrook Road  
Private Bag Rangiora

G.N. McVicar  
McVicar Timber Group Ltd  
550 Johns Road  
Harewood  
Christchurch

B. Griffin  
Millstream Lumber  
Factory Road  
P.O. Box 13  
Milton

The General Manager  
Mitchpine Products Ltd  
Foxton Road  
R D 12  
Levin

The General Manager  
Moore Levesque & Morris Ltd  
162 Queen Street  
P.O. Box 78  
Cambridge

The General Manager  
Moutere Timber Ltd  
Cnr Wilsons Rd & Moutere Hw  
P.O. Box 3132  
Nelson

D. Urquhart  
Mt. Iron Timber  
Anderson Road  
R D 2  
Wanaka

The General Manager  
Neil Timber  
83 Portage Road  
Private Bag  
Auckland

Ross Richardson  
Niagara Sawmilling Co Ltd  
Anglem Street  
P.O. Box 542  
Invercargill

The General Manager  
NZ Hardwood Timber Ltd  
23 Patiki Road  
P.O. Box 71082  
Auckland

The General Manager  
NZ Log Homes  
Ridge Road  
c/- Lake Okareka Post Office  
Rotorua

P.B. Oliver  
Oliver & Haua Ltd  
64 Maleme Street  
P.O. Box 2639  
Tauranga

The General Manager  
Otago Lumber Ltd  
Bush Road  
P.O. Box 40  
Otago

The General Manager  
Pacific Pine Industries Ltd  
Domain Road  
P.O. Box 117  
Putaruru

The General Manager  
Pan Pacific Forest Industries (NZ)  
Ltd  
State Highway 2  
Private Bag 6203  
Napier

G.R. Wells  
Parapine Timber N.Z. Ltd  
Park Street  
P.O. Box 40324  
Wellington

R. Everard  
Paynter Timber Ltd  
14 Fisher Crescent  
Post Code 1006  
Auckland

The General Manager  
Pedersen Eucalypt Chipping Ltd  
P.O. Box 1895  
Rotorua

The General Manager  
Pukepine Sawmills Ltd  
Main Road  
P.O. Box 41  
Te Puke

V.W. Richardson  
Richardson Ltd, A. Nolan  
Nelson Road  
R D 1  
Gisborne

The General Manager  
Rimco Ltd  
63 Cypress Drive  
P.O. Box 38351  
Wellington

D. Harvey  
Rosebank Timber Ltd  
Main South Road  
R D 3  
Balclutha 9200

The General Manager  
Rosedale Sawmill Ltd  
41 Rosedale Road  
Albany  
Auckland

The General Manager  
Ross Usmar & Associates  
2-4 Pine Hill Crescent  
P.O. Box 35481  
Auckland

The General Manager  
South Pine Ltd  
Quarantine Road  
P.O. Box 554  
Nelson

R.J. Hawkins  
Stoneyhurst Timbers Ltd  
Dickeys Road  
Belfast  
Christchurch 8005

S.C. Stuart  
Stuart Timber Co Ltd  
Main Road  
P.O. Box 23  
Tapanui

M.R. Sutherland  
Sutherland & Co Ltd  
197 Ohoka Road  
Post Code 8252  
Kaiapoi

The General Manager  
T & J McIlwaine Ltd  
35 Russell Street  
P.O. Box 75  
Marton

M.W. Jones  
Taranaki Sawmills Ltd  
Hudson Drive  
P.O. Box 49  
New Plymouth

A.T Johnston  
Tasman Lumber Co Ltd  
7-9 Alpers Avenue  
P.O. Box 9119  
Auckland

The General Manager  
Taylor Timbers Ltd  
194 Ranzau Road  
Hope  
Nelson

The General Manager  
Te Kumi Timber Co Ltd  
Orini Road  
P.O. Box 25410  
Auckland

The General Manager  
Thailand Exports NZ Co Ltd  
430 Ngongotaha Road  
P.O. Box 1127  
Rotorua

B. Marshall  
Thomas J.H. & Co Ltd  
Te Tipua  
R D 4  
Gore 9700

The General Manager  
Timber Finishings Ltd  
82-86 Hull Road  
P.O. Box 4112  
Mt. Maunganui South

The General Manager  
Timbertank Enterprises Ltd  
5 Pembroke Crescent  
P.O. Box 18239  
Auckland

G. Templeton  
Tongariro Timber Ltd  
285 St. Aubyn Street  
P.O. Box 49  
New Plymouth

D. Sadler  
Transport Waimate Ltd  
166 Queen Street  
P.O. Box 74  
Waimate

Stan Udy  
Udy Sawmills Ltd  
10 McVie Road  
Huntly

J.B. Valintine  
Valintine Sawmilling Co Ltd  
James Street  
P.O. Box 33  
Inglewood

The General Manager  
Vinhy International (NZ) Ltd  
10 Ronald Macken Place  
Mairangi Bay  
Auckland

The General Manager  
W Crighton & Son Ltd  
Main Road South  
P.O. Box 82  
Levin

M.C. Daniel  
Waihemo Timber Co Ltd  
Dumbuck Road  
P.O. Box 105  
Otago

R.W. Gibbons  
Waimea Sawmillers Ltd  
Bolt Road  
P.O. Box 7004  
Nelson

The General Manager  
Waipawa Timber Supplies Ltd  
Harker Street  
P.O. Box 146  
Napier

The General Manager  
Westmoreland Box Co Ltd  
47 Airdrie Road  
P.O. Box 70048  
Auckland

The General Manager  
Whittaker Sawmilling  
Herewini Street  
Masterton

The General Manager  
Wienk Industries Ltd  
46-54 Frost Road  
P.O. Box 57023  
Auckland

R. Peterson  
Winstone Pulp International Ltd  
44 Khyber Pass Road  
P.O. Box 8890  
Auckland